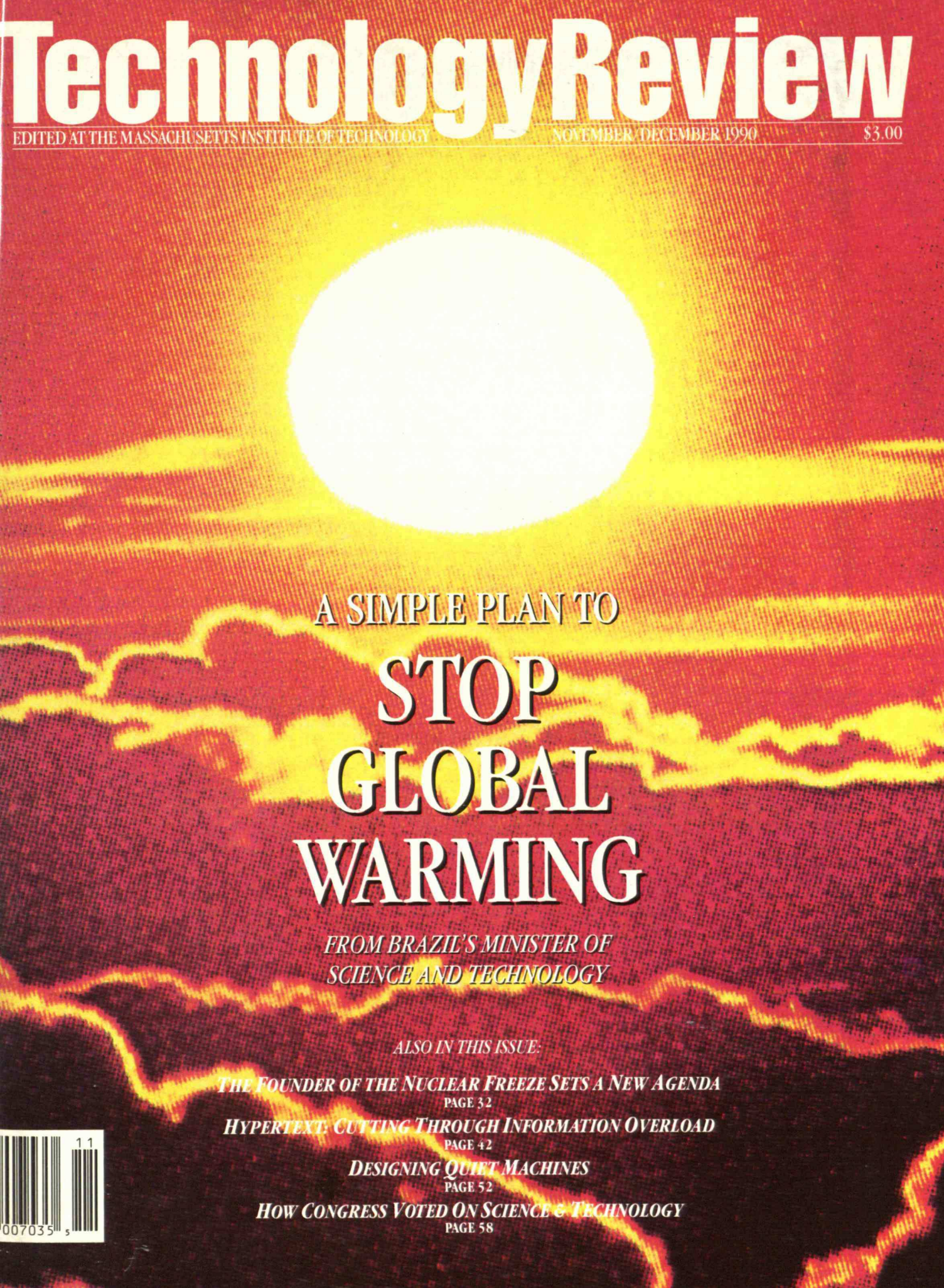
# Technology Review

EDITED AT THE MASSACHUSETTS INSTITUTE OF TECHNOLOGY NOVEMBER/DECEMBER 1990 $3.00

## A SIMPLE PLAN TO

# STOP GLOBAL WARMING

*FROM BRAZIL'S MINISTER OF SCIENCE AND TECHNOLOGY*

*ALSO IN THIS ISSUE:*


*THE FOUNDER OF THE NUCLEAR FREEZE SETS A NEW AGENDA*
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*DESIGNING QUIET MACHINES*
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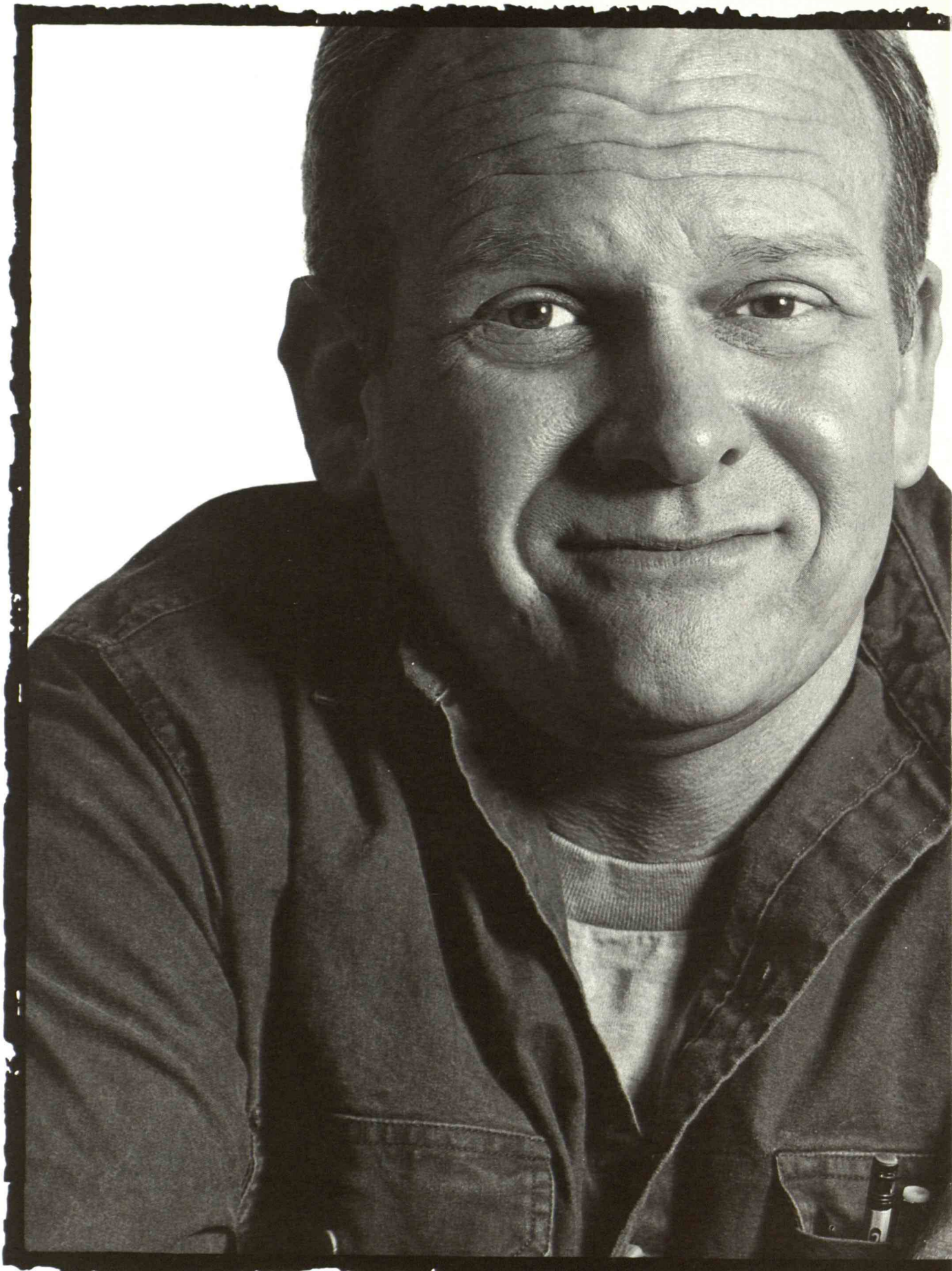
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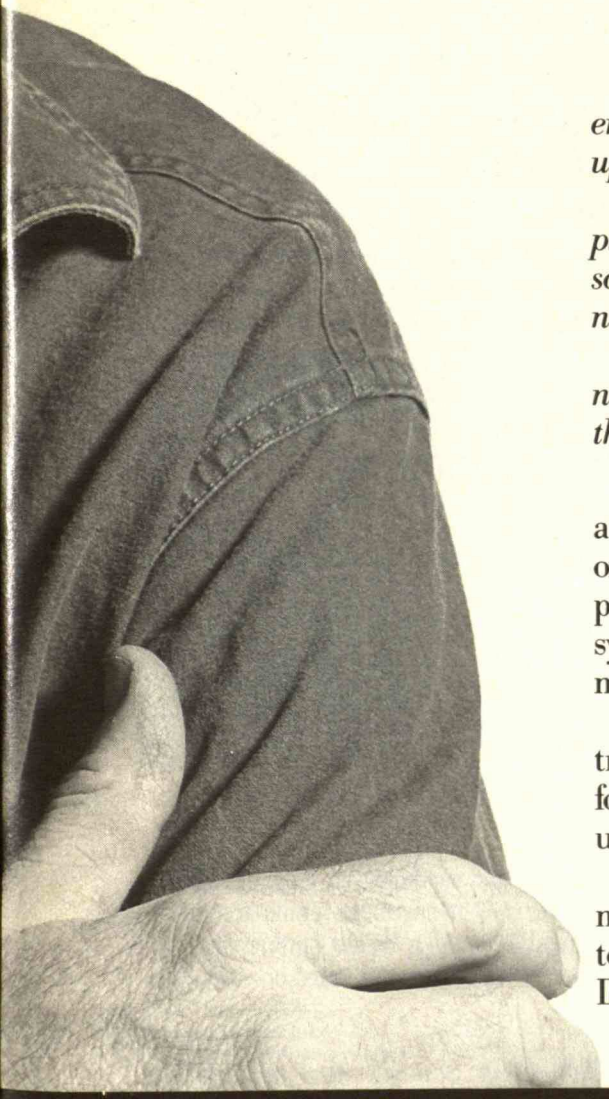
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TECHNOLOGY REVIEW
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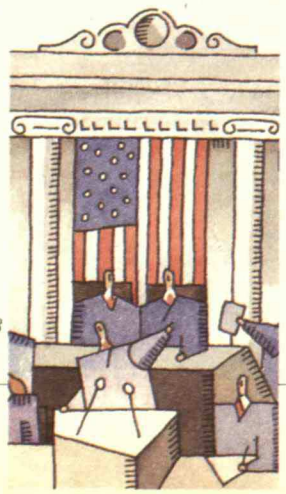



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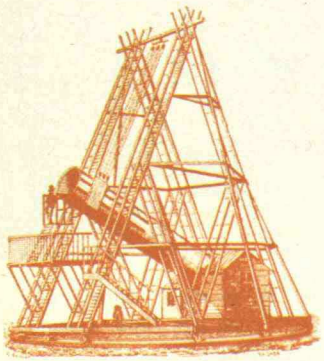

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# FirstLine

## New Faces and Old

A magazine editor is like a conductor, encouraging one theme, discouraging another, ensuring a measure of coordination and perhaps a kind of vision. But most of the creativity must come from a wide community: the editors, the art department, authors whose work appears and advisors whose work is less obvious, the business department (making a work of imagination pay requires imagination), and the owners, who put the entire enterprise in motion. Several changes have recently occurred in *Technology Review*'s community. Some should improve the editorial content of the magazine, while others will help maintain a stable operation, and still others simply mark the passing of time.

To make room in her day for three young children, Nancy Cahners has stepped down as design director after a dozen years but continues part-time as senior designer. Under her tenure, we have won so many awards from the most prestigious design organizations that we've all lost track of the actual number. Among Nancy's many skills is her ability to convince extraordinary artists to accept our modest fees. One illustration that took my breath away was the child-like drawing by Susan LeVan of a red hammer-and-sickle of stars against a black sky for our October 1987 cover story, "What the Soviets Are Doing in Space."

I'm delighted to announce that Kathleen Sayre has accepted the position of design director. She has already run the design department during Nancy's maternity leaves and did *Technology Review*'s handsome redesign that appeared last January. One of numerous covers that have benefitted from her ingenuity was for May/June 1986. A list read, from top to bottom: "Mercury, Venus, *, Mars, Jupiter, Saturn, Uranus, Neptune, Pluto." Below the list: "* Superpowers never resolved arms-treaty verification." Kathy rescued this grim humor from dreariness with a simple backdrop of unevenly spaced lines suggesting the planets' orbits.



*From left to right: Herb Brody, Kathleen Sayre, Laura van Dam, Dorothy Finnerty, Nancy Cahners.*

Readers who have asked for a harder technological edge to some articles will appreciate the knowledge and perceptions of Herb Brody, who became a senior editor here after many years at *High Technology* and a couple at *PC Computing*. His clear, engaging words were evident in his article on "The Neural Computer" in August/September. Also, after returning from a maternity leave, Laura van Dam was promoted to senior editor and put to work strengthening "MIT Reporter," which readers value as a window into the Institute. That done, she started a new feature: Our first photo essay, on the tunnel under the English Channel, ran in October, and one on archeological uses of computers in Pompeii will follow in January.

Dorothy Finnerty, our subscription service manager, is moving to Florida. For more years than anyone remembers, she literally and figuratively turned the lights on at *Technology Review* every morning, and we don't know what we'll do without her.

Finally, we reconstituted our former Advisory Board as the Technology Review Board with more direct fiscal responsibilty from our owner, the MIT Alumni/ae Association—and several former members will be missed. Robert C. Cowen of *The Christian Science Monitor* has been advisor, columnist, and confidante of the magazine for two decades and has contributed more to the magazine than I even know of. Fred Jerome of the Scientists' Institute for Public Information has written for the magazine—one remarkable piece examined the gag order that the U.S. government issued on information about Chernobyl—and has counseled me in particular. Like the students who could often be seen in the hallways clustered about Louis Menand, a political scientist recently retired from MIT, we will miss his wise advice. And responsibilities as dean of the Sloan School of Management have claimed Lester Thurow, the well-known economist, who first wrote for *Technology Review* in the mid-1970s and has served on our board. ■

JONATHAN SCHLEFER



PHOTO: L. BARRY HETHERINGTON

Asia Series

# You can do business in Japan without shelling out a fortune.

For many companies, the biggest barrier to new markets has been the cost of business trips. Restaurants can be expensive, and even the smallest accommodations may carry oversized bills. Yet those willing to be a little adventurous will find that traveling comfortably in Japan doesn't require packing a suitcase full of yen.

## Hop on the bus.

A $20 bus ride from Narita Airport may not strike you as a bargain, but compared to a $150 taxi, it is. The buses marked "Airport Limousine" stop at all the major hotels in Tokyo.

## Sleep cheap.

Business hotels are a fairly new phenomenon. Catering primarily to Japanese businessmen, they're clean, functional, and conveniently located. Although vending machines replace amenities like room service, at $40 to $50 a night these hotels are a sound investment. Two major chains are the Tokyu Inn (tel. 03/406-0109) and the Washington (tel. 03/434-5211).

## Food for naught.

It should come as no surprise that you'll save money eating where the locals eat. Good and reasonably priced restaurants can be found in department stores and the basements of office buildings. At lunch, ask for *teisboku*. It means special of the day, and includes rice, miso soup, salad, meat or fish, and dessert—all for around five dollars. *Ramenya* and *sobaya* (noodle shops) are perfect places for a quick and tasty meal.

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# Letters

## SAVING THE CHILDREN

I have read with great distress Jonathan Schlefer's article "Children and Investment" (*First Line, TR April 1990*). Not once does he mention birth control as a way of helping children in crisis. His article is reminiscent of the late 1940s and early 1950s, when we were just recovering from World War II and becoming aware of the problems indigenous to less-developed nations. Have we learned nothing in the last 40 years about fertility rates and their impact on the welfare of new children? Mr. Schlefer's solution is apparently to pour money into already overpopulated regions. He doesn't seem to understand that such funds are likely to simply exacerbate difficulties in cases where an effective birth-control program has not been established.

I fully agree that we should do all we can to eradicate misery in the world. But Mr. Schlefer needs to do more research and less breast beating. I would ask that he compare life-expectancy figures for planned economies with those for free economies. After all, the under-five mortality rate is only part of the picture.

MARVIN L. BAKER
Houston, Tex.

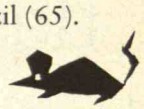
*The author responds:*

It's true that fast population growth can make it harder to raise living standards. However, although development agencies have been concerned about this since the 1960s, foisting birth control on Third World nations has done little good. The current thinking is that if parents are confident their children will reach maturity, they may not feel compelled to have so many. Also, if children are given better education, they become an economic liability for more years, so parents will want fewer. Of course, in the long run the additional education more than pays for itself.

One should note as well that economic gains and population growth can occur together, and there is evidence that they tend to during early industrial development. The U.S. population experienced an enormous sustained increase from 23 million in 1850 to 123 million in 1930, but the standard of living rose substantially at the same time.

My article did compare the life expectancy in China (70) with that in India (58). According to UNICEF's *State of the World's Children,* Cuba (74) does better than Latin American nations such as Mexico (69) and Brazil (65).

## MORE ON ASPARTAME



Data are available that negate most if not all the points Steven Farber raises as causes for concern in "The Price of Sweetness" (*TR January 1990*). First, he states that aspartame "alters the composition of neurotransmitters," that "a soda sweetened with aspartame can change the brain's chemistry." Yet published research (some from my own laboratory) indicate that rats require enormous doses of aspartame to experience even marginal neurotransmitter effects. Furthermore, those effects would never occur in humans, because aspartame is 180 times sweeter than sugar and thus would not be consumed in such large amounts. Published human data clearly suggest that a soda containing aspartame will not in fact change the brain's chemistry.

Farber also says that the neurotransmitter changes supposedly caused by aspartame can "influence a person's mood and diet or cause such neurologic problems as seizures or headaches." Here he is assuming that the phenylalanine contained in aspartame will inhibit a key enzyme (tyrosine hydroxylase) in the synthesis of a particular neurotransmitter family (the catecholamines). But published findings indicate that this is not the case. Moreover, other data are available to disprove the alleged association between aspartame and these neurologic problems: when reputed aspartame-sensitive subjects don't know they are consuming the sweetener, the claimed effects do not occur.

Another weakness in Farber's article lies in his discussion of people with phenylketonuria, who degrade phenylalanine slowly. He implies that if any of the estimated 10 million individuals who are carriers of this condition in-

gest aspartame, they may suffer brain damage because of the increased amounts of phenylalanine in their blood. However, studies of humans who have phenylketonuria provide more than sufficient data to show this concern about aspartame use by such individuals to be insupportable.

Finally, in claiming that aspartame does not diminish appetite for carbohydrates, Farber refers to a mechanism involving the neurotransmitter serotonin. He says that chocolate cake, for instance, will raise humans' level of this neurotransmitter, "which regulates the proportion of protein and carbohydrate we eat." The usual outcome, he tells us, is that we stop wanting carbohydrates. He adds that cake sweetened with aspartame rather than sugar will not have the same result. But the regulatory mechanism he is talking about is actually highly speculative and indeed not supported by reproducible data. His argument thus has no foundation in fact.

And even if the carbohydrate regulatory mechanism did exist, Farber has not applied it with much thought in his chocolate-cake example: replacing the sugar with aspartame would not remove the carbohydrate signal in the cake anyway. The problem is that chocolate cake contains not only sugar but flour, which, when digested in the gut, produces sugars that do exactly the same thing to brain serotonin as the sugars in sucrose. More generally, Farber's focus on the carbohydrate-serotonin hypothesis and on "carbohydrate craving" suggests that he has little knowledge about appetite control and metabolic regulation. The issue is much more complex than he implies.

Because Farber's discussion of aspartame issues that I know about is so unidimensional, I can only wonder about the validity of his comments in other areas. Thus, I must sadly discount the entire article, though I believe regulation of our food supply—and the FDA's role in it—to be an important issue.

JOHN D. FERNSTROM
Pittsburgh, Pa.

*John D. Fernstrom is a professor of psychiatry and behavioral neuroscience at the University of Pittsburgh School of Medicine.*



*The author responds:*

Fernstrom narrowly focuses his criticisms on my analysis of data that link aspartame to changes in brain neurotransmitters. Yet the point of my article was that aspartame doesn't even provide the benefits it claims to. An American Cancer Society survey of 78,000 women casts doubt on the sweetener's efficacy in weight control. And research by Joyce E. Wise at the University of Illinois College of Medicine and Stephen Colagiuri at the University of New South Wales suggests that there is no benefit afforded to controlled diabetics who consume aspartame as opposed to sucrose.

Also, Fernstrom's own research indicates that aspartame can in fact alter brain neurotransmitters in rats. He dismisses these findings on the grounds that adverse effects in humans would "never" occur because aspartame is not consumed in large enough doses.

This raises the question of how one should extrapolate data from rats to predict effects in humans. A comparison based solely on metabolic rate would indicate that rats would have to be given aspartame in doses 10 times higher per gram of body weight than those humans consume. But it is becoming widely accepted that this simple comparison is often not relevant because it ignores the biochemical differences between species. Some evidence indicates that rats have a much higher level of phenylalanine hydroxylase, an enzyme that converts phenylalanine to tyrosine. That would offer rats greater protection from the phenylalanine in aspartame and indicate that rats would have to be given doses 100 times higher than those for humans. Whether one decides that aspartame is likely to adversely alter brain neurotransmitters depends on what factor one chooses.

Fernstrom goes on to cite evidence that supposedly disproves the association between aspartame and neurologic problems. He is referring to work by Susan S. Schiffman of Duke University, which shows that people who said aspartame induced their headaches were actually no more sensitive to aspartame tablets than to a placebo. However, most consumers do not get their aspartame in tablets; they get it in food and drink. Louis J. Elsas, a physician writing in the *New England Journal of Medicine,* criticizes the Schiffman study, stating that "perhaps a more unbiased peer review of clinical research protocols would have produced a better designed experiment." He argues that the work was slanted toward Nutrasweet Co., which supported the experimental design. Three more headache researchers have written separately to the journal outlining methodological flaws in Schiffman's study.

Two other headache experiments argue that aspartame can trigger migraine. Richard B. Lipton of Albert Einstein College of Medicine surveyed 171 headache patients and found that the ones who suffered from migraines were "three times as likely to report that aspartame triggered their headaches." In a placebo-controlled study of migraine sufferers, Shirley M. Koehler of the University of Florida found that aspartame increased the frequency of migraine. And numerous other studies suggest that aspartame can be associated with neurologic ailments.

As for Fernstrom's charge that my concern about carriers of phenylketonuria is "insupportable," these peo-

*Continued on page 79*

# MIT Reporter



*Peak heights in the Alps and some other "young" mountain ranges could be due to accelerated erosion rates that allowed the remaining masses to rise like boats being unloaded.*

## How the Mountains Got So High

Geologists who study mountain ranges presumed to have developed "recently"—in the past 5 to 10 million years—have often said that the structures have risen. But the idea that the average elevations have increased in areas like the Rockies and Alps could be largely wrong, say Peter Molnar, senior research scientist in MIT's Earth, Atmospheric, and Planetary Sciences Department, and Oxford University geophysicist Philip England.

Molnar and England suggest in a recent issue of *Nature* that some "young" mountain ranges appear quite tall today primarily because the erosion rate has accelerated and made their valleys deeper. These ranges differ from older mountain belts that are thought to have developed through movements of geological plates, Molnar explains.

Molnar and England's argument rests on upending several notions proposed by different geologists. For example, some scientists have said the sharp relief of many mountains suggests these areas have recently grown. Researchers have also cited certain plant fossils that have been found in mountainous regions: the closest living relatives of these plants are in warmer climates. This could indicate that the land that's now mountainous once had a lower elevation and was therefore warmer.

To cast doubt on all this, Molnar and England take a critical look at an old idea: that mountain-range "uplift" contributed to global cooling millions of years ago. Among other things, scientists have advanced the idea that the increased snow cover on the taller peaks should lead to dropping temperatures.

Molnar and England argue the evidence for rising mountain peaks "could, in large part, be a consequence of the very climate changes that this supposed uplift is thought to have caused." For instance, many studies on fossilized plants ignore the fact that most of the globe cooled during the period in question, they say.

As far as the idea of sharp relief goes, the geophysicists hypothesize that the growing cold—and, they think, a stormier climate, especially in the last 2 to 3 million years—could have increased the rate of glaciation and erosion. That could have cut deep canyons and sharp ridges and removed rock and sediment to surrounding plains. Then the mountain peaks, which would have been lighter, could have risen like boats in water after being unloaded. The process is known as "isostatic rebound."

All this may have set up conditions that are still in effect, Molnar and England propose. Snow cover on the ever-taller mountain tops might last longer, causing further global change, more erosion, and more isostatic rebound. In other words, mountain climbers have it easy today. Getting to the top of many peaks could take even longer several million years from now.—*LAURA VAN DAM edits MIT Reporter.* ■

## Measuring Electrical Use Unobtrusively

To predict future electricity needs, utilities have for years studied use patterns by attaching meters to individual household appliances. But such research is expensive—as much as $1,200 per household. Now, for about $250, a single "smart" meter located outside a house can identify a wide range of appliances and monitor their use. So says Richard Tabors, assistant director at MIT's Laboratory for Electromagnetic and Electronic Systems, who headed a group that completed work on the device last winter.

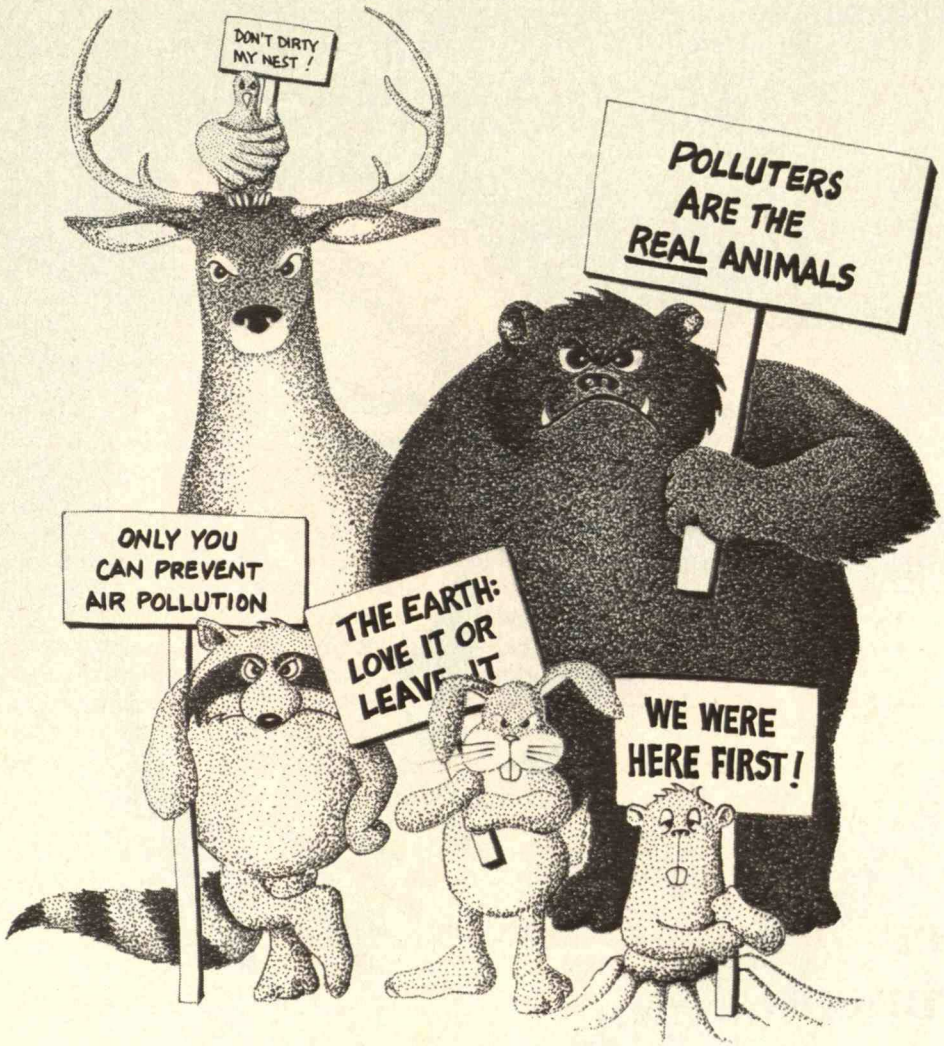
A smart meter—properly called a "non-intrusive appliance-load monitor"—



*A "smart" meter can be connected to a traditional electric meter to identify and monitor the use of many appliances.*



PHOTOS: THE BETTMANN ARCHIVE; AMERICAN SCIENCE AND ENGINEERING




# CITIZENS FOR NUCLEAR ENERGY

Nuclear energy is one of the cleanest, most abundant sources of electricity in America. And that makes nuclear energy very popular among citizens from all walks of life.

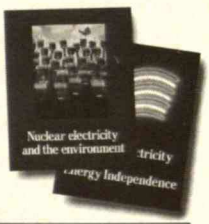
Nuclear electric plants generate electricity cleanly, without polluting the atmosphere.

In fact, nuclear energy helps reduce airborne pollutants in the U.S. by over 19,000 tons every day.

And because nuclear electric plants don't emit carbon dioxide, they don't add to the greenhouse effect, potential global warming and its adverse effect on the environment and our quality of life.

America's 112 nuclear electric plants are our second largest source of electricity. But they won't meet the demands of a growing population and economy. We need more plants.

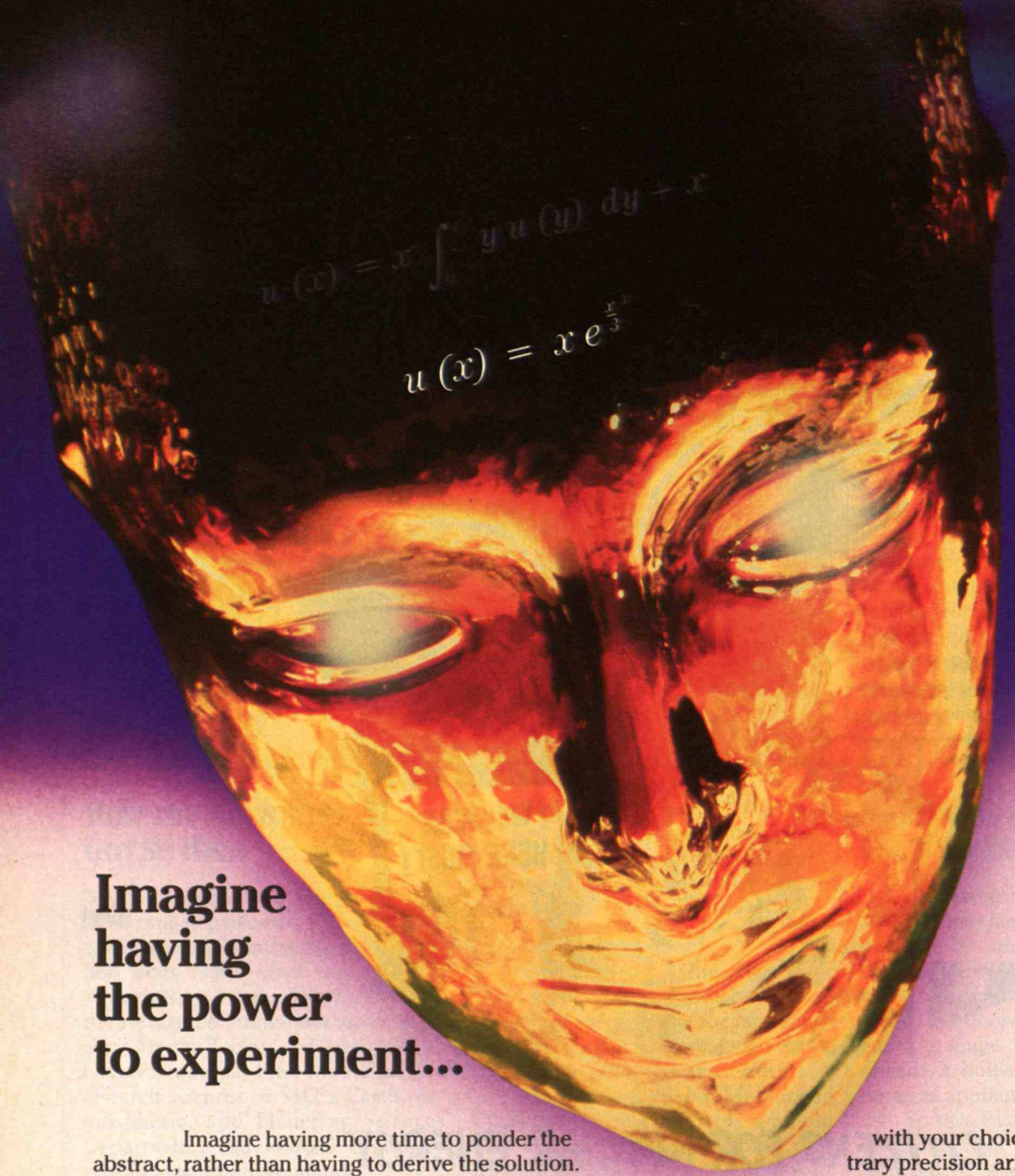
For more complete information about nuclear energy, write to the U.S. Council for Energy Awareness, P.O. Box 66080, Dept. CI19, Washington, D.C. 20035.




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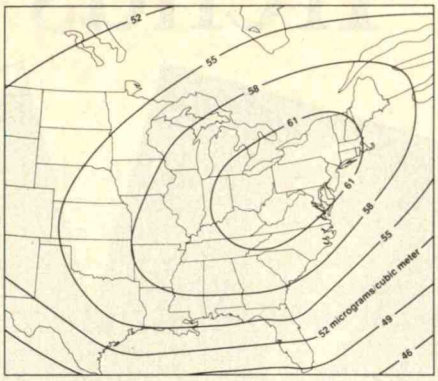
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works by sampling changes in voltage and current at a rapid rate, once per second. To determine what appliances are being used, the meter draws on information about their operating characteristics. For example, a refrigerator has a specific voltage cycle and turns on and off a certain number of times in an hour. In tests at more than a dozen homes, the smart meter has accurately identified about 50 appliances, Tabors says.

Although the meter enables electric-utility researchers to get information at lower cost, some privacy experts worry that the device would monitor lifestyles and infringe on individual rights. MIT sociology professor Gary Marx offers two troublesome scenarios. Manufacturers of, say, VCRs might buy information from utilities about which neighborhoods have few VCR users and then aggressively market their products to households there. And in a totalitarian society, smart meters could be used to limit free speech: agencies could check for personal computers or printing presses in households. Tabors acknowledges the concern about privacy, and says utilities "should never use this device without prior permission of the owner."

Tabors and other researchers are trying to develop a similar meter for commercial buildings. Assistant professor of building technology Leslie K. Norford, electrical engineering associate professor James Kirtley, and Tabors want to create a meter that could also anticipate equipment failures and then alert building managers. This meter would sample 1,000 times faster than the appliance-load monitor. That speed would make it possible to track the different amounts of power drawn by electrical equipment as it turns on and off. The meter would learn how equipment normally functions and then continue to record data, with any divergence in patterns serving as a red flag to technicians. "By sampling much faster," Norford says, "we can have a much better chance of diagnosing problems."—*LINI S. KADABA is a reporter for the* Philadelphia Inquirer. ■




*A model indicates that throughout eastern North America, ozone concentrations averaged over April to September do not fall abruptly in rural areas.*

## NEW PREDICTIONS ON OZONE POLLUTION

As much as half the ground-level ozone—which can cause environmental problems—comes from natural processes, and therefore can't be reduced by changing human activities. So says an MIT Energy Laboratory preliminary modeling study by James A. Fay, Dan S. Golomb, and Stephen G. Zemba. To make matters worse, cutting human-produced emissions of the gases that react to form ozone doesn't always bring about a proportionate reduction in the ozone itself.

This means those emissions "have to be dealt with pretty severely to get the ozone levels to where they won't be unhealthy," Fay says. He believes that in some cities, such as Los Angeles and New York, the human-produced emissions will have to be cut by more than half.

Ozone is well known as the gas that, when it's in the stratosphere, helps protect people from the sun's dangerous ultraviolet rays. Near the surface of the earth, however, large amounts of ozone can cause respiratory problems and crop losses. Ground-level ozone forms when precursor gases—nitrogen oxides and volatile organic compounds—react in sunlight. In the past, the amounts of nitrogen oxides from power plants and motor vehicles and the amounts of volatile organic compounds—emitted by everything from gasoline refineries to dry-cleaning and printing plants—have caused ground-level ozone problems.

In 1987 about 60 metropolitan areas violated the standards on peak ozone levels set by the U.S. Environmental Protection Agency. Now regulators are also talking about setting "secondary standards" aimed at bringing down average concentrations of ozone.

In response, the Energy Lab team has developed a computer model that, fed with known amounts of precursor emissions, tracks how they move, mix, and react. Unlike traditional models that focus on single urban areas, this one covers eastern North America. It predicts, averaged over a six-month period, ozone concentrations even where they haven't been measured.

The researchers have been surprised to find that even though cities spew out most of the precursor emissions humans produce, average ozone concentrations don't fall off abruptly in rural areas. Moreover, concentrations of ground-level ozone are quite high everywhere. This explains why so many areas, both urban and rural, encounter unhealthy peak concentrations.

According to the model, the average levels of ozone are elevated both because the wind can carry ozone long distances, and because the volatile organics emitted by vegetation can produce large quantities of the gas. The model's estimate of naturally produced ozone is consistent with findings of investigators who have established the ozone "background" by measuring levels in remote regions. Those researchers did not determine if their readings came solely from natural sources.

Using the model, the MIT scientists have found that cutting human-produced emissions of nitrogen oxides and volatile organics in half would lower seasonally averaged ozone by less than 10 percent. That might be satisfactory in many areas, "but the big cities are in deep trouble," Fay says. The model also indicated that paring nitrogen-oxide emissions would be more effective than trimming emissions of volatile organics.

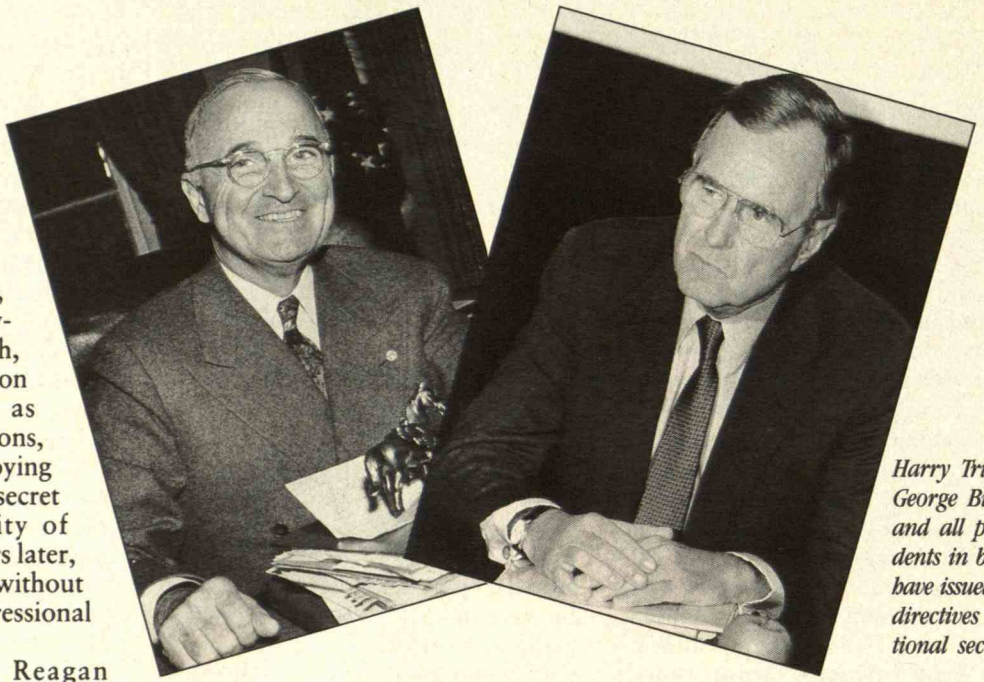
The model contains enough uncertainties that it cannot be used to determine detailed steps needed to achieve secondary standards, Fay stresses. But the findings indicate the need for more extensive measurements, especially of volatile organic compounds.—*NANCY STAUFFER edits the MIT Energy Lab's* e-lab *newsletter.* ■

DIAGRAM: MIT ENERGY LABORATORY

# Trends

## Secrets of the Presidents

For 43 years, presidents have used the National Security Council, an advisory body in the government's executive branch, to issue secret directives on such wide-ranging issues as arms sales, covert operations, summit meetings, and deploying nuclear weapons. These secret decrees, the vast majority of which remain classified years later, let presidents make policy without public knowledge or congressional debate.



*Harry Truman, George Bush, and all presidents in between have issued secret directives on national security.*

Especially during the Reagan administration, which campaigned for greater government secrecy on several fronts, civil liberties groups attacked some of these decrees as threats to personal freedom. Kate Martin, director of the American Civil Liberties Union (ACLU) National Security Litigation Project, says civil libertarians also question whether the directives, which usually stay in effect indefinitely, need to stay secret.

Most presidents rename the decrees. Ronald Reagan, who issued the most—at least 303—called them National Security Decision Directives (NSDDs). Only about 50 have been declassified. George Bush, who issued at least 13 in his first 18 months as president, shortened the title to National Security Directives (NSDs, pronounced "nizdees").

Neither Congress nor the public knows if Bush has continued Reagan's unprecedented use of secret directives. Jeff Richelson, a consultant on NSDs to the nonprofit National Security Archives, believes that "because there are fewer ideologues in this administration, there are fewer disputes and therefore fewer leaks of classified NSDs." Richelson says the Bush NSDs are known to cover the subjects of nuclear weapons deployment, Panama, and support for Afghan rebels.

According to Martin, there are only a few circuitous—and usually unsuccessful—ways to find out what's in a NSD. Under the Freedom of Information Act, anyone can ask the National Security Council to release one; if that fails, a lawsuit can be tried under the same act. Alternatively, Congress can request a NSD or ask that it be made public. So far, legislators have been able to obtain some directives. Finally, public pressure may force the release of a NSD.

But even these recourses presuppose knowledge of a decree's existence and subject. Congress or its constituents may never learn that a NSD exists unless it is leaked or eventually declassified—the most common ways NSDs come to light.

Frank Askin, a consultant to the House Government Operations Committee, would like the Bush administration to release "a directory of directives, so that the public knows which ones exist, even if they are still classified." Both the Reagan and Bush administrations have refused to turn over a full list.

### Reporting Hostile Contacts

Martin charges that a few NSDs blatantly limit civil liberties. The two most infamous, which became well known when prominent Reagan administration members refused to comply with their terms, may be Reagan's 1983 NSDD 84, "Safeguarding National Security Information," and NSDD 196, "Counterintelligence/Countermeasure Implementation Task Force," issued two years later.

Along with other strictures on federal employees who have access to classified information, NSDD 84 originally proposed that all authors among them undergo federal review before publishing any article or book for the rest of their lives. It became public when outgoing U.N. ambassador Jeane Kirkpatrick refused to comply, and the administration dropped the requirement for all but CIA employees. Secretary of State George Shultz wouldn't go along with 196, which proposed periodic lie detector tests of government employees and contractors in a position to leak sensitive information. Congress and civil liberties groups are challenging the constitutionality of these edicts, which could continue to bind millions of government workers at certain agencies.

Gary Stern, who monitors the decrees for the Center for National Security Studies, which is sponsored by



PHOTOS: UPI/BETTMANN NEWSPHOTOS

the ACLU and the Fund for Peace, maintains that some NSDs erode civil liberties in a more subtle manner. Sometimes, he says, the problem is the over-zealous way agencies implement a directive. A case in point is NSDD 197. "Reporting Hostile Contacts and Security Awareness," declassified within a few months of being issued in 1985, directs all agencies to set up a system requiring employees to report any encounters with representatives of hostile powers.

Last February, Stern discovered that the Department of Housing and Urban Development (HUD) had gone far beyond the NSD and required employees to report "just about any contact with any foreigner from the eastern bloc or other Communist countries." Says Stern, "It's hard to believe that many people at HUD could be the targets of hostile powers." Since then, HUD has promised to revise its procedure.

Some journalists think the decrees infringe on the public's right to know. William Arkin, coauthor of *Encyclopedia of the U.S. Military,* which lists the history and subjects of all known directives, sees them as part of a concern for "keeping everything 'sensitive' out of the hands of the press"—more than out of the hands of hostile powers.

No one appears to be demanding the abolition of NSDs, in part because their subjects and the degree to which they may infringe on legislative power vary greatly. Veteran reporter Walter Pincus, who covered Contragate for the *Washington Post,* echoes the general opinion: "There are real secrets, and at times you need a vehicle for them."

Arkin points out that at least a NSD involves a formal process—"someone writes it; someone edits it; someone approves it." He notes, "That bugs me less than the elliptical, uncoordinated, verbal and written guidance that initiates very important policies. No NSD authorized the Libya bombing in April 1986. North and Poindexter didn't use NSDs." ■

*George Bush issued 13 or more secret security directives in his first 18 months as president. At least one deals with support for Afghanistan's mujeheddin rebels.*

*ANN MARIE CUNNINGHAM is a* Technology Review *contributing writer.*



PHOTO: SONJA ISKOV, IMPACT VISUALS

# Generation Bridge

John had long dreamed of becoming a basketball star. It was *one* career filled with talented black men. After playing with some wire, a battery, bells, and light bulbs, though, the 10-year-old has decided to be an engineer.

"At least he knows there are other options," laughs Harold Sharlin, director of the Emeritus Scientists, Mathematicians, and Engineers Program. The volunteer project, which operates in the District of Columbia metropolitan area, links retired scientists, mathematicians, and engineers with public schools, exposing inner-city children—the younger the better—to a host of exciting science careers.

"Early contact is extraordinarily important," says Sharlin, who is an electrical engineer and education consultant. "Kids can see scientists as real people. *They* can be scientists if they work hard. Particularly in the D.C. area, we're surrounded by technical agencies and businesses. . . . Kids don't have to work at McDonald's or be professional football or basketball players."

Besides opening vistas for children, Sharlin's project responds to perceptions that the United States needs more technically trained people. According to the American Association of Engineering Education (ASEE), the United States already employs more engineers than lawyers, doctors, or even elementary school teachers. Moreover, the profession and demand are growing, says Donald Strong, a consultant to the ASEE.

Other programs exist to link retired professionals with curious young minds. For 12 years, retired teachers in the District of Columbia have provided tutoring help in reading and basic math to six inner-city schools, while social workers evaluate programs in various United Way agencies throughout the District. Programs in Florida, Arizona, California, and

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*Washington, D.C., students tour a Potomac Electric Power Co. generating station with Emeritus Foundation director Harold Sharlin (second from left).*

Texas steer retired lawyers into legal services offices for the benefit of low-income clients.

In 1989-90, the Emeritus program's first year of classroom experience, six engineers and scientists and one physician started working in Bunker Hill Elementary and Taft Junior High. Both District of Columbia schools are predominantly black, in student body and staff. Both draw children from middle-income and lower-income families. And both inspire high achievement from their pupils. Taft was recognized as a "school of distinction" in the D.C. system for its students' academic achievements and its broad array of advanced curricula. By mid-year, the program had doubled the number of instructors and added two more schools, Phoebe Hearst Elementary and John Eaton Elementary.

The outcome? "The children were thrilled," says Clotile Knight, a fifth-grade teacher at John Eaton. Sharlin introduced her class to the concepts of electricity and helped children conduct simple versions of Faraday's and Oersted's experiments. At the end of the unit, the class toured a utility company power plant. "They were able to relate all the things that he taught them to the plant," recalls Knight. "And several children wanted to be engineers."

### Older and Wiser

The backbone of the Emeritus program is a six-week unit, capped by a field trip to a lab, museum, plant, or agency. Emeritus instructors spend at least one hour in the classroom each week, and they collaborate with teachers to design relevant—and understandable—curricula.

This can be challenging. In fact, claims William J. Condell, "It's hard!" Previously the director of physics at the Office of Naval Research, Condell notes that it takes careful preparation "if you're accustomed to expressing yourself in calculus and then have to . . . bring it down to the simplest, most transpar-



PHOTO: COURTESY OF POTOMAC POWER COMPANY

ent level." Condell explored lens equations and Newtonian mechanics with sixth graders who "really understood quite a bit." But, he adds, he spends as much time preparing for these classes as he did for lectures at George Washington University.

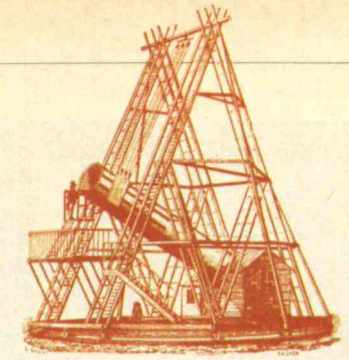
Emeritus participants agree that the hard work is rewarded. Before he retired from the State Department, Samuel Zweifel was Henry Kissinger's personal doctor. Now he delights at the enthusiasm of the fourth and sixth graders in his health classes. "It's really nice to be with these youngsters and know that they wanted me to be there. They were extremely attentive—always raising their hands, wanting to participate. They were excited about everything." Zweifel uses his own transformation from Kansas farmboy to State Department physician to inspire the children.

Sharlin sees the program as a necessary supplement to established science and math studies, in part because some teachers seem uncomfortable with science and steer clear of it. For example, in one school, he observed that a kit crammed with batteries, compasses, and other simple science equipment had never been touched. "But we're old enough that teachers aren't afraid to ask us things," says Sharlin.

Sharlin's goal is to reach into every elementary school in the area, and he'd like to see the program replicated in other cities. "There are a lot of people out there with real talent, who want to do something for children. I can't tell you how many scientists and engineers the program will help inspire 20 years from now, but I know we have an influence."

Still, after two semesters in the schools, Sharlin has a confession: "I don't want teachers to leave the classroom when I'm leading the class. I'm terrified of fourth graders." ■

*CHRISTINA M. NICHOLS, a free-lance writer based in Washington, D.C., specializes in the environment and energy.*



# Spare-Time Stargazing

Ana Larson is disappointed by the problems with the mirrors on the Hubble Space Telescope (HST).

That's not surprising. Her plan to search for planets around other stars, a task requiring very-high-resolution images, is on indefinite hold until the HST's optical flaws can be fixed.

What is surprising is that Larson even has a chance to use HST. Homemaker and mother of two, Larson is an amateur astronomer just entering a master's program at the University of Victoria.

In July 1989, Riccardo Giacconi, director of the Space Telescope Science Institute, chose Larson and four other amateurs to share 17 hours of valuable observing time on HST. It was the first chance for amateurs to come "aboard" a major U.S. space observatory.

Astronomy is perhaps unique among the physical sciences in that amateurs—an estimated 300,000 in the United States—play a significant research role. Indeed, until the late nineteenth century, only a fine line separated amateurs and professionals. Some of the best-known astronomers of old were part-timers: Copernicus, for instance, was an ecclesiastic; Kepler, a horoscope caster; Herschel, a musician. Even after formal observatories were established, says Jean Claude Pecker of the College de France, amateurs carried out work as sophisticated as that of the pros.

That parallelism essentially ceased with the formation of academic societies and, more important, the advent of giant telescopes. With observing time expensive and limited, professionals abandoned prosaic efforts, such as monitoring variable stars, for observing more exotic objects—distant galaxies, peculiar stars, globular clusters—and doing research in astrophysics and cosmology.

This left amateurs with a niche: amassing data on a host of phenomena requiring long-term observations, repeated follow-up, and computation. According to Smithsonian astronomer Brian Marsden, "Even if all professional astronomers wanted to pursue this routine, there would not be enough of them to monitor everything that needs to be watched."

Today, amateurs are discovering comets and supernovas, identifying double stars, counting sunspots, and recording meteor showers. Increasingly, they use electronic detectors, spectrographs, and even radio



*Until recently, even famous astronomers were amateurs. For example, William Herschel, a musician, built the 40-foot telescope above. Today amateurs participate in major astronomy ventures like the Hubble Space Telescope.*

ILLUSTRATION: PIONEERS OF SCIENCE; PHOTO: NASA

telescopes, once the province of large observatories.

Individuals, usually working with little reward other than pride in their accomplishments, conduct most of this research with their own equipment. Yet because they are unfettered by institutional demands, these individualists can often be enlisted in large collaborative efforts. For example, at the dawn of the Space Age, the Smithsonian Astrophysical Observatory organized the Moonwatch Network, volunteers who spotted artificial satellites and provided the basic data necessary for precise tracking. From 1957 to 1975, some 5,000 amateurs made a half-million observations of 6,000 objects. And during the 1985-86 return of Halley's comet, the Jet Propulsion Lab organized the International Halley Watch. Over 900 amateurs joined professional observatories in providing almost continuous coverage of the comet.

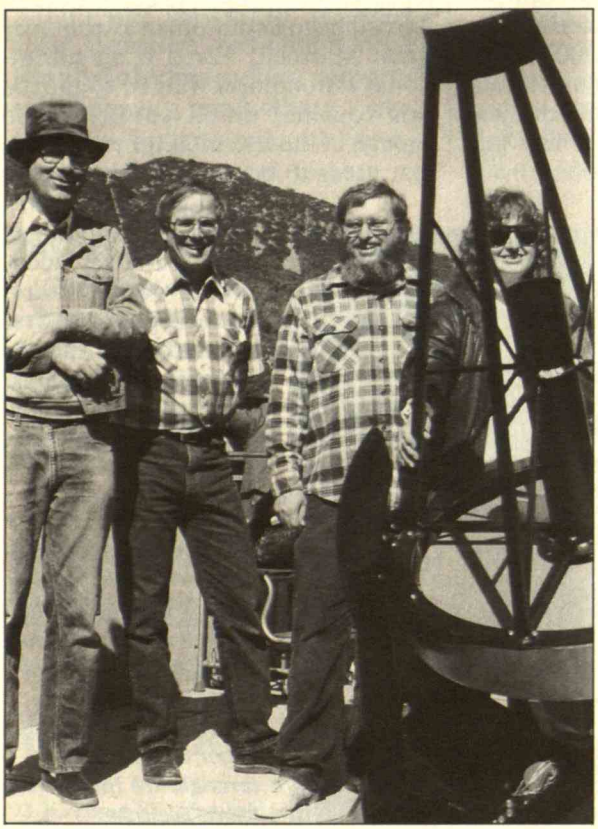
The most venerable effort is the American Association of Variable Star Observers (AAVSO), headquartered in Cambridge, Mass. Founded in 1911, its 1,300 members worldwide monitor 3,000 stars that change brightness on cycles ranging from hours to years. Such stars are typically either very young or very old, and their varying brightness offers clues to the evolution of stars.

As chief scientist for the Einstein (HEAO-2) Observatory in 1978, Riccardo Giacconi used the AAVSO as an early-warning network to spot erupting stars so that an x-ray satellite could catch them at peak emission. This experience helped him decide to give HST time to Larson and the three other amateurs.

### Professionalized Amateurs

Despite that rare recognition, most amateurs are unsung, conducting time-consuming, labor-intensive—and often mind-numbing—tasks. But a new trend in amateur astronomy eliminates the routine by automating observations. Now one-time amateurs can sell their services.

About a decade ago, spurred by lower-cost detectors, optics, and computers, independent groups began building small robot scopes capable of untended operation. Because these automated photoelectric telescopes (APTs) are programmed to observe selected objects on schedules and are linked by phone to computers, they're ideal for repetitive observations of variable stars and other cyclic phenomena.



*One-time amateurs Russ Genet (left) and Lou Boyd (second from right) now collect data with automated telescopes. They market this service to professionals like Smithsonian scientists Sallie Baliunas and David Latham.*

Two amateur pioneers, Phoenix-based engineers Lou Boyd and Russ Genet, formed the Fairborn Observatory and convinced the Smithsonian to install six APTs in an unused building at its Whipple Observatory in southern Arizona. In return, Boyd and Genet would observe the waxing and waning of spots on a group of Sun-like stars.

In an age when the costs of building an observatory at a dark, clear site—or even traveling to one—are prohibitive, researchers can "rent a star" for about $2. Every clear night now, the roof of the Arizona building rolls back. Each robot locks onto a designated star, makes an observation, and then moves to another target. At dawn or if the sky clouds over, the roof closes, and the data are automatically transmitted to Phoenix or elsewhere.

Fairborn's APTs help Smithsonian scientist Sallie Baliunas measure magnetic activity on stars. She used to watch the same stars 12 hours a night, "until required observations simply exceeded the limits of my endurance." Now, says Baliunas, "I can program telescopes by modem and obtain the data I need without even leaving my office."

Despite the new professionalism, amateur astronomy remains a labor of love. As Jean Claude Pecker noted at a 1987 gathering of amateurs and professionals in Paris, the French word for amateur "derives from *aimer,* to love, and that is what we all have in common—our love for things of the sky, our enthusiasm for celestial spectacles, . . . our passion for the sun, the stars, the galaxy." ■

*JAMES CORNELL is publications manager for the Harvard-Smithsonian Center for Astrophysics.*



PHOTO: SMITHSONIAN INSTITUTION WHIPPLE OBSERVATORY



# Traveling with Mother (Nature)

*Ecotourism is booming as travelers seek to experience unspoiled nature. For instance, Sobek Adventure Tours takes clients on elephant safaris in Nepal.*

Last year, the *Bahia Paraiso,* a freighter carrying over 80 tourists, rammed into rocks a few miles off Antarctica's Anvers Island, spilling hundreds of thousands of gallons of fuel into the ocean.

In 1987, the number of cheetahs in Kenya's Amboseli Reserve dropped from 15 to 5, in part because of the growing number of safaris.

These two events, 4,500 miles apart, stem from a common problem: in both, an unspoiled ecosystem is at risk because of the tourists it attracts.

Although little hard data exist on "ecotourism," the industry mushroomed in the 1980s, as did its cousin "ethnotourism," which focuses on indigenous groups and cultures. This growth is part of the overall explosion in travel—from $83.3 billion in 1979 to $208.7 billion in 1989. Poor countries, which host the bulk of ecotours, earned $55 billion from tourism in 1988.

"Most of the world lives in homogenized, urban settings," says Barbara Johnson, an anthropologist at Simon Fraser University in Vancouver, British Columbia. "Therefore, we want to see the rainforests and the indigenous people. People go whalewatching out of a sense that there are only a few whales left."

Diverse groups ranging from universities and conservationists to for-profit companies offer trips that fall under the loose rubric of ecotourism—also known as nature, green, or soft-path tourism. There are even guidebooks to help the would-be ecotraveler assess the merits and demerits of the many options.

Depending on the type of trip, participants can play various roles. Travelers on Pax World Foundation's "Agroforestry in Antigua" Caribbean tour plant trees and grow crops on impoverished land. On Earthwatch projects, volunteer researchers pay an average of $1,300 to assist scientists. The tasks include measuring turtle eggs, recording the calls of male katydids, and sizing clams and mapping their distribution.

In most cases, travelers are passive observers rather than active participants. At the upscale end, Private Jet Expedition's personalized African safaris feature anthropologists as guides and travel by luxury plane. Sierra Club, the Smithsonian Institution, and for-profits such as Wildland Journeys offer more moderately priced eco-vacations.

Usually, the hosts' philosophies are mirrored in the expectations of the participants. Pax World Foundation stresses ecological or political goals. Sobek, an adventure travel outfitter, donates a percentage of its revenue to Rainforest Action Network, an advocacy group. Above the Clouds Trekking, which runs tours to Nepal and South America, solicits funds for the Society for the Preservation of Traditional Cultures.

PHOTO: JACK HOLLINGSWORTH/SOBEK PHOTO FILE



*Ecotravelers to Sumatra can share a bit of time with bohoruk orangutans. Unfortunately, this type of tourism could endanger the natural ecosystems on which it depends.*

### Preservation versus Development

Promoters of alternative tourism point to its contribution to economic growth, such as providing developing nations with badly needed foreign capital and infrastructure. A survey by World Wildlife Fund's Elizabeth Boo indicates that nature travelers spend more than recreational travelers. Also, ecotourism can raise the environmental consciousness of participants and protect what Barbara Johnson calls "wilderness, wildlife, and 'wild people' " from destructive development.

However, not every nation may be able to choose ecotourism exclusively. For example, Costa Rica is trying to strike a balance between catering to traditional tourism—with its high-rise hotels and marinas—and protecting the country's coasts, rainforests, and wildlife preserves. If Costa Rica pursues only ecotourism, damage to the environmental, social, and cultural milieus will be minimal, but at the cost of millions of dollars of income every year, according to a study by Georgia State anthropologist Carole Hill.

Brian Farrell, a geographer from the University of California at Santa Cruz, describes a different potential shortcoming. A Maui Island developer and hotel owner won praise for being sensitive to Hawaii's environment, hiring local labor, and proposing to include affordable housing in the projects. But the resort company that bought him out is now rapidly building up Maui. This has forced up rents, restricted access to beach front, and dampened wages. Without laws to restrict development, islanders had counted on the good graces and vision of one individual.

Others say the question isn't just about economics. Ecotourism, if poorly planned and monitored, can threaten the culture and authority of indigenous people, as well as the environment.

Mac Chapin, from Cultural Survival, a non-profit group working with indigenous people, believes that "what is often left out in the design of wildlife preserves or management plans is the input of people who live there." Thus, Cultural Survival sponsors conferences at which indigenous groups exchange topographical surveys, resource-use plans, and other technical information. Such forums give them the confidence they need to make decisions and develop policies.

But the most pressing question is how many tourists a fragile ecosystem can sustain, even if it is carefully regulated. To answer this question, Kurt Johnson, a biologist with Earthwatch, is developing a "tourism carrying capacity" for part of Tibet.

Johnson considers factors like how well the vegetation, rivers, wildlife, and local residents can handle a projected number of visitors, and he compares his findings to the revenue the visitors would bring. The result, he hopes, could be broadly applied to help planners "determine the maximum number of people who can visit a given area without damaging it." ■

*ANN CLAIRE GREINER is a free-lance writer specializing in workplace issues and travel.*

## Sailing to Mars

When Christopher Columbus set sail for India in 1492, he and his crew had to rely on the winds to push their three ships westward. A half-millennium later, scientists and engineers may commemorate that odyssey by staging another historic voyage—a race to Mars by a flotilla of robot spacecraft.

In the spirit of Columbus, the ships will be sailboats of a sort. The gentle pressure of radiation from the sun, caught in vast, thin sails, will nudge the ships forward on their months-long trip to the Red Planet. Klauss Heiss, project chair for the Columbus 500 Space Sail Cup, says that besides being fun, the race "will demonstrate that these vessels are hardy enough for future interplanetary travel."

Although any space-sail vessel can enter, the Christopher Columbus Quincentenary Jubilee Commission that is sponsoring the race plans to select three lead entries, which will be named the *Nina,* the *Pinta,* and the

*To honor Columbus's voyage to America, Johns Hopkins scientists hope to send a space sail 550 feet in diameter to Mars.*

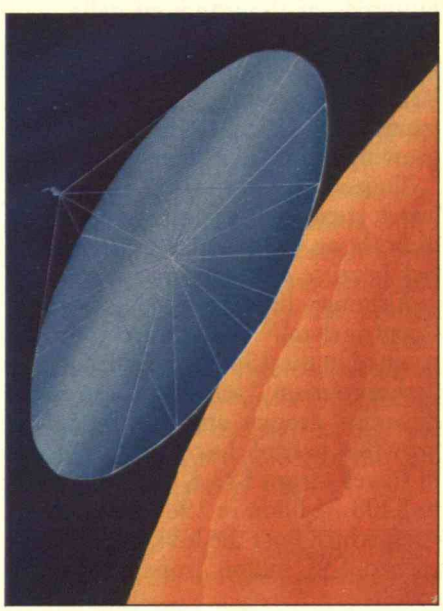




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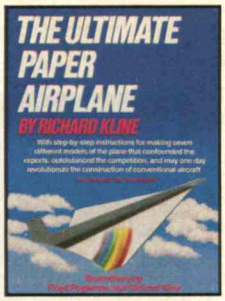
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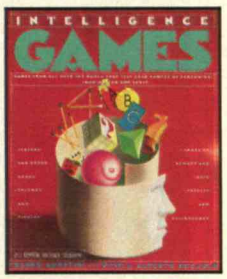
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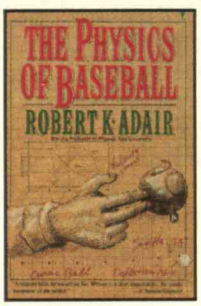
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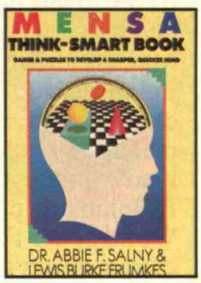
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*Santa Maria*. One will represent Europe, where Columbus started. The Americas, where he landed, will be represented by a craft designed by the World Space Foundation of Pasadena, Calif. The third entry will come from Asia, where Columbus thought he was going.

In October 1992, the trio—and others that the commission can accommodate or that find their own rides into space—will be lofted to an orbit 1,000 miles above the earth. At that height, they will be able to unfurl their sails without interference from the atmosphere.

The "sailboats" are of many proposed designs. A team from the Johns Hopkins University Applied Physics Lab in Baltimore has proposed Sunflower, a lightweight aluminized sail. Shaped like a disk about 550 feet in diameter, it would be held flat by a large hoop. According to the American Institute of Aeronautics and Astronautics, Sunflower has the best technical merits of the U.S. proposals.

Others have come up with even more unusual designs. Andreas von Flotow, professor of aeronautics and astronautics at MIT, has proposed a heliogyro, an asterisk-shaped sail with eight 12-foot arms that would spin slowly to keep them stiff. The Canadian Space Society has proposed a hexagonal sail composed of thin, rotating strips. And the competition has attracted attention from overseas, with entries from Italy, the Soviet Union, Great Britain, China, Japan, and France.

Once Sunflower, or any sail, opens in space, it would take advantage of the sun's radiation pressure—the force created when radiation reflects off a surface. The much weaker "solar wind," the flow of gases outward from the sun, would play a tiny role, but even the radiation pressure itself is tiny: Sunflower would take over seven minutes to speed up one mile per hour.

Still, the sun is nothing if not relentless, and the gradual acceleration eventually would have visible effect. In three months, the craft would be traveling fast enough to escape its orbit, and 500 days later it could reach Mars. And, just as a sailboat can tack, the spacecraft could adjust its sail to change direction and speed. This means it could maneuver without heavy propellants, says Emerson LaBombard, project director for the World Space Foundation team. Their entry features a square-shaped sail almost 10,000 feet across.



### Billboards for Hire

Harold Fox, program manager for Sunflower, expects the regatta to show that robot craft could ferry supplies to astronauts visiting Mars. He also says that while en route to Mars, his group's entry could navigate past near-earth asteroids. An on-board television camera could transmit pictures of these little-observed rocks.

However, just as Columbus had trouble lining up backers, organizers of the space competition are encountering rough waters. Estimates for the cost of developing and building a single sailcraft run as high as $15 million.

The commission originally promised competitors that it would raise funds for the project, but this spring Heiss announced that none were forthcoming. He encouraged teams to find their own backers, and since then the sailors have been scrambling—without getting any firm commitments yet.

What's in it for sponsors? For one thing, Fox points out, corporate America may see the race as one way to stimulate young people's interest in high-tech careers. Like the Apollo project did in the 1960s, the race could help foster a fresh generation of



ILLUSTRATION/PHOTO: WORLD SPACE FOUNDATION



*A World Space Foundation craft has been selected to represent the United States in the 1992 space-sail race.*

trained workers for U.S. industry. Patriotism is another reason, he adds. But advertising may be the most powerful drive. Columbus flew the flag of Spain, whose Queen financed him, and the decals of contractors are already plastered on many U.S. rockets. The Mars craft could raise the marketing value of space to new heights.

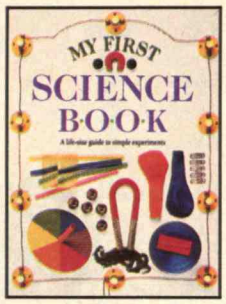
Physically getting the sailcraft into space poses yet another challenge. The World Space Foundation entry might weigh 1,100 pounds, so the group may hire a ride on a French Ariane booster, LaBombard says. The Soviet Union, known for its heavy-lift boosters, also may give a helping hand. Heiss says he and Soviet officials are talking about the possibility of lifting sails with a Proton rocket.

Some craft would be easier to launch. Von Flotow points out that Pegasus, a rocket developed by Orbital Sciences Corp. for the Pentagon, could lift MIT's 40-pound entry.

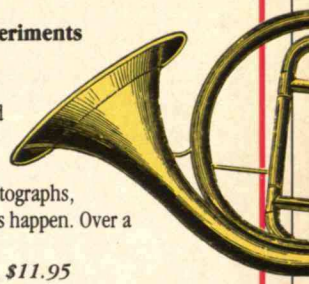
"A Pegasus launch would permit departure from Columbus's original port in Spain, Palos de Moquer in the Huelva province," according to Von Flotow. That, he says, would be a fitting start to another era of discovery and exploration. ■

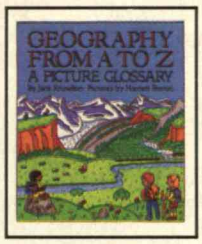
*VINCENT KIERNAN covers military issues for* Space News.


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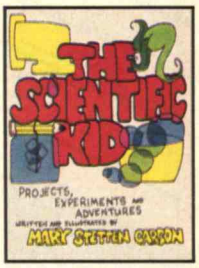



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# How to Stop Global Warming

BY JOSÉ GOLDEMBERG

*A "carbon tax" of about $1 per barrel of oil would pay for measures to slow the increase in greenhouse gases.*

ILLUSTRATIONS: BRIAN LIES

LIKE few other environmental problems, the specter of global warming unites humanity in a common task. Every time anyone in the world lights a wood stove, or starts a car, or burns an acre of forest, the atmosphere receives another dose of carbon dioxide and other greenhouse gases that threaten catastrophe in decades or centuries to come.

About 60 percent of the greenhouse gases entering the atmosphere come from the burning of fossil fuels. Therefore, unless we see startling advances in such alternative sources as nuclear fusion or photovoltaics, any serious proposal to head off global warming must attack the problem of reducing the world's demand for energy.

The good news is that the industrialized countries have been moving for many decades toward a more energy-efficient path. The oil price hikes of the 1970s only accelerated a decades-old trend away from heavy manufacturing and construction toward services and other less energy-intensive activities.

*Intensive energy use can be seen as a spike in our economic development, not as a baseline to which we will inevitably return.*



*Physicist José Goldemberg, Brazil's secretary of state for science and technology, offers a straight-forward prescription to head off global warming.*

While this reduction in energy bodes well, there is an elephant in the basement. The less developed countries (LDCs), and to a lesser extent the centrally planned economies of the Soviet Union and Eastern Europe, will display a steadily increasing energy appetite as they evolve into industrial economies. With more than three times the population of the industrialized world, the LDCs bristle at the idea that they must curtail their energy use. The political leadership and populace of these poorer nations believe they deserve the chance to grow; they are unwilling to forgo development even if development means burning massive amounts of fossil fuels and obliterating more forests.

To stabilize atmospheric concentrations of greenhouse gases at today's levels, the U.S. Environmental Protection Agency (EPA) recently estimated that it would be necessary to cut emissions of $CO_2$ by 50 percent, of methane by 10 percent, of chlorofluorocarbons (CFCs) by 75 percent, and of nitrous oxides by 80 percent.

Unfortunately, such cuts would probably be impractical, because they would severely constrain economic development. A more modest target emerged from the Toronto Conference on Climate Change in 1988. There, the world's industrialized nations agreed on a goal of cutting greenhouse gas emissions 20 percent by the year 2005. This would not stabilize atmospheric levels of greenhouse gases but would at least slow their accumulation.

Although difficult to achieve, the Toronto goal is certainly reachable. Newer, more efficient technologies can lower energy consumption without affecting economic output. CFC-substitutes can provide refrigeration. In fact, an international "carbon tax" of just $1 per barrel of oil, or $6 per ton of coal, would generate more than enough revenue to pay for the necessary fuel-saving measures. This tax could result from an international agreement similar to the 1987 Montreal Protocol, which obliges its signatories to cut down on production of CFCs.

### Why the World Needs Less Energy

The industrialized world has already made important progress toward slowing energy growth. Between 1973 and 1986, for example, the U.S. gross domestic product (GDP) increased 36 percent while the consumption of energy remained about constant. In other words, the "energy intensity" of the U.S. economy—the ratio of energy use to GDP—fell an average of 2.4 percent a year. A similar decline occurred in Canada and Western Europe.

Part of the drop in energy use has come as a response to rising oil prices. Industry in particular has improved the efficiency of its operations, both by substituting less power-hungry machines and by streamlining its procedures to reduce waste. In the United States, government-imposed automobile mileage standards have doubled fuel efficiency, from an average of 14 mpg in 1973 to 28 mpg in 1987.

Environmental considerations are bound to accelerate this drop in energy intensity. Pressured by public concern about the habitability of the planet, political leaders in the developed countries will probably begin to impose regulations designed to cut $CO_2$ emissions to meet the Toronto Conference goal. A 1989 Canadian study concluded that energy efficiency measures

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*JOSÉ GOLDEMBERG is Brazil's secretary of state for science and technology and a professor of physics at the University of São Paulo.* *This article is based on a paper presented at the Conference on Energy and the Environment, held at MIT in March. A longer version will appear in* Energy and the Environment in the 21st Century, *to be published in November by MIT Press.*

could get that country three-quarters of the way toward the Toronto Conference's target—saving Canadians $100 billion through lower energy bills as well as fulfilling a planetary responsibility.

But the drop in energy use reflects more than simply a short-term economic reflex. The energy intensity of the industrialized world has been steadily decreasing for decades. The only deviations from this trend have come during a comparatively brief span of time in each society when it was putting in place an infrastructure of heavy industry, roads, bridges, and houses. This undertaking demands huge amounts of materials such as wood pulp, paper, chemical fertilizers, hydraulic cement, steel, copper, and aluminum—all of which require a lot of energy to produce. Accordingly, when a country's per-capita GDP is $2,000 or less, consumption of energy-intensive materials closely correlates with economic activity. At higher GDPs—when the infrastructure has presumably already been put in place—the coupling weakens.

Once the infrastructure is built, economic activity tends to move toward services, which inherently use less energy than manufacturing. Intensive energy use can thus be seen as a spike in our economic development, not as a baseline to which we will inevitably return. Viewed in this light, the oil-price hikes of the 1970s only quickened the pace of structural changes in the industrialized countries.

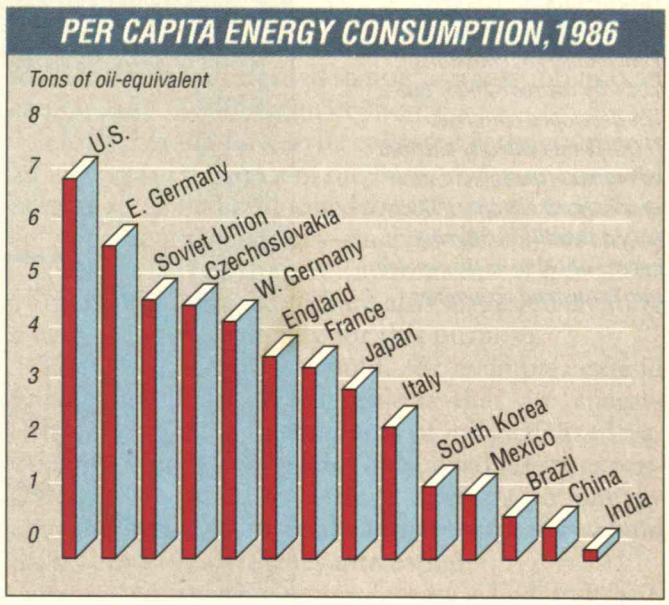
All countries appear to follow this pattern (*see the chart on page 30*). What's more the later a country develops, the more efficient are the manufacturing methods and transportation systems it adopts—and hence the less accentuated is the peak in its energy intensity. In the 1880s, for example, the British economy consumed roughly 1 ton of petroleum-equivalent (TEP) to generate each dollar of GDP; intensity fell precipitously through the turn of the century and has declined steadily ever since. The United States reached a lower peak—about 0.9 TEP—around 1920.

Energy use has also declined in the United States and Europe because heavy industry is rapidly migrating out of these regions. In 1986, the "embodied energy" in goods and services imported by the United States—that is, the energy that went into producing them—equaled about 3 percent of total U.S. energy use. If present trends continue, that figure will rise to 25 percent during the next 10 to 20 years. This does not represent any net gain on a global scale but merely transfers energy use from developed to developing countries.

## Third World as Villain?

The migration of heavy industry to other parts of the world signifies an important trend: North America and Western Europe are dominating world energy consumption less and less. Per-capita energy use by the LDCs has been growing for a long time and shows no sign of saturation. Though still consuming at only a fraction of the U.S. level, LDCs will catch up with the industrialized countries in about 20 years if today's energy patterns continue. Rapid growth in energy demand will also come from the centrally planned economies of the Soviet Union and Eastern Europe, as these countries struggle to gain an equal footing with the West in the post–Cold War era.

Growing energy use in the developing countries poses a thorny problem. On the one hand, LDCs require energy to escape poverty. Their consumption must grow at least as fast as GDP to build an infrastructure. On the other hand, public sensitivity on environmental preservation in these countries is weak. Political leaders and the populace have accepted a growth-at-all-costs philosophy, even if it means compounding the environmental damage already done by industrialized coun-




*Growth in energy use will come mainly in the developing world, which now uses only a fraction of the amount of energy per capita that industrialized nations do.*

CHARTS: DEBORAH PERUGI DESIGN

tries. The eradication of misery and poverty has dominated their economic agendas.

The result is that developing countries are adding large amounts of $CO_2$ and other greenhouse gases to the atmosphere. Over the next 10 to 15 years, for example, China plans to install some 100 gigawatts of coal-fired electricity generation and to build 100 million refrigerators that use CFCs.

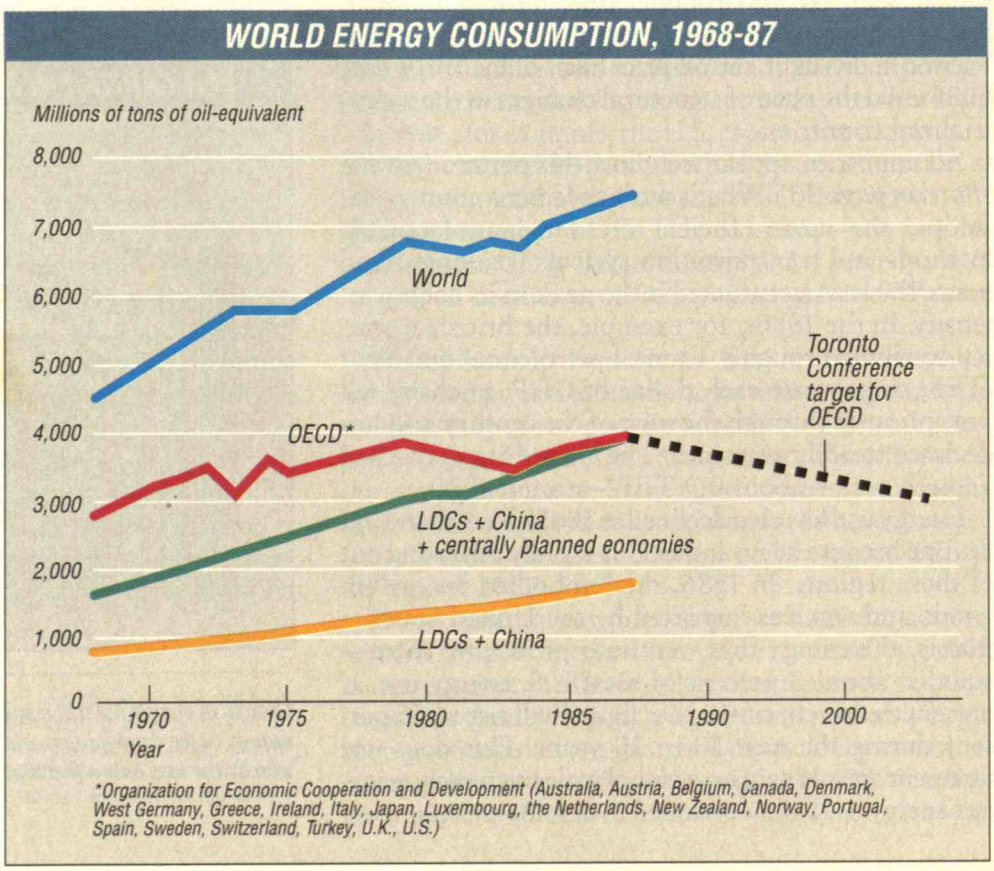
Some LDCs regard deforestation as necessary for development, even though tropical forests are unique ecological systems—and even though the land, once denuded, cannot sustain agriculture and pastures for very long. The massive obliteration of tropical forests in this century accounts for about one-fourth of the $CO_2$ now in the atmosphere. Burning the forests dumps massive quantities of $CO_2$ into the air, and the eliminated vegetation is no longer available to remove $CO_2$ from the air. Africans alone burn some 300 million tons of wood a year, representing the deforestation of at least 5 million acres of land and accounting for some 4 percent of the world's $CO_2$ emissions. Such practices also hurt the local ecology, increase soil erosion, kill off species, and alter local climates.

As developing nations' energy use comes under international scrutiny, many LDC leaders are concerned that their countries will be made the scapegoat for the world's environmental woes—that industrial countries, acting under the banner of planetary preservation, will try to deny them the opportunity to grow economically. Unlike the industrialized countries, LDCs cannot lower their energy consumption without retarding their development.

Thus, although action is urgently needed to halt environmentally destructive practices, the world at large should not—and probably could not—force the LDCs to shoulder the entire burden of solving global warming. We cannot expect the same people who just cleared a rain forest to plow under their new plantation and replant the forest, even though such an act would serve the world at large. Acting both through duty and in their long-term self-interest, the developed nations should help the LDCs onto an environmentally benign path.

To some extent, this is already happening. After the 1972 Stockholm World Conference on Environment,

*At the 1988 Toronto Conference on Climate Change, OECD nations agreed to cut greenhouse gas emissions 20% by the year 2005. But less developed countries (LDCs) and centrally planned economies (the Soviet Union and Eastern Europe) will display a steadily increasing energy appetite as they evolve into industrial economies.*



*The international investment needed to stop the buildup of greenhouse gases is $30–45 billion per year—less than half of one percent of the industrialized world's total gross domestic product.*

the international community grew more aware of the environmental implications posed by the developing world. The industrialized nations tried to satisfy environmental concerns in many LDC projects. The World Bank, for example, now requires exhaustive environmental impact studies before approving loans for major construction projects in the Third World.



**A Toll for Using the Planet**

Though the long-term gain will be profound, in the short term most of the actions needed to arrest $CO_2$ emissions will be costly. The consulting firm McKinsey and Co. prepared a study for the November 1989 Ministerial Conference on Atmosphere Pollution and Climatic Change, held in Noordwijk, the Netherlands. The total international investments needed to stabilize the atmosphere, the study concluded, are on the order of $30–45 billion per year.

The report gives the following breakdown:

■ *CFC phase-out:* Developing and manufacturing refrigeration technologies that do not require CFCs would cost $150–200 million per year at first, and $600–700 million per year thereafter if the goal is to eliminate 100 percent of CFCs.

■ *Forest management:* Reforestation would cost about $400 per acre, so $10–15 billion per year could take care of roughly 25 to 40 million acres. That would more than compensate for the present rate of deforestation, eliminating a major cause of $CO_2$ buildup.

■ *Energy conservation:* Because the payback can be long, individuals and businesses often need financial incentives to invest in energy-efficiency measures. Funding of $20–30 billion per year—roughly half of it for the LDCs—should be enough to pay for measures such as retrofitting factories with more modern, less wasteful machinery. Some of this money would be spent not just on efficiency but on fuel switching. Eastern Europe in particular could change over most of its electricity generating plants from coal to methane, which emits less greenhouse gas.

Since this is a global problem, it makes sense to exact the money needed from the international community. Happily, the solution does not require measures as severe as doubling oil prices, as was recently suggested by several U.S. analysts. Indeed, a levy of just $1 per barrel of oil-equivalent, or $6 per ton of coal-equivalent, would generate an income of $50 billion per year—more than enough to pay for the ecologically necessary measures. As fuel-efficiency improves, and the world uses less carbon, this revenue stream will decrease—but so will the need for it.

The purpose of the carbon tax would not be primarily to discourage energy consumption, any more than a highway toll is intended to discourage automobile travel. Rather, the tax would be a fair and effective way to raise the money needed to fund a transition into an ecologically more benign economy.

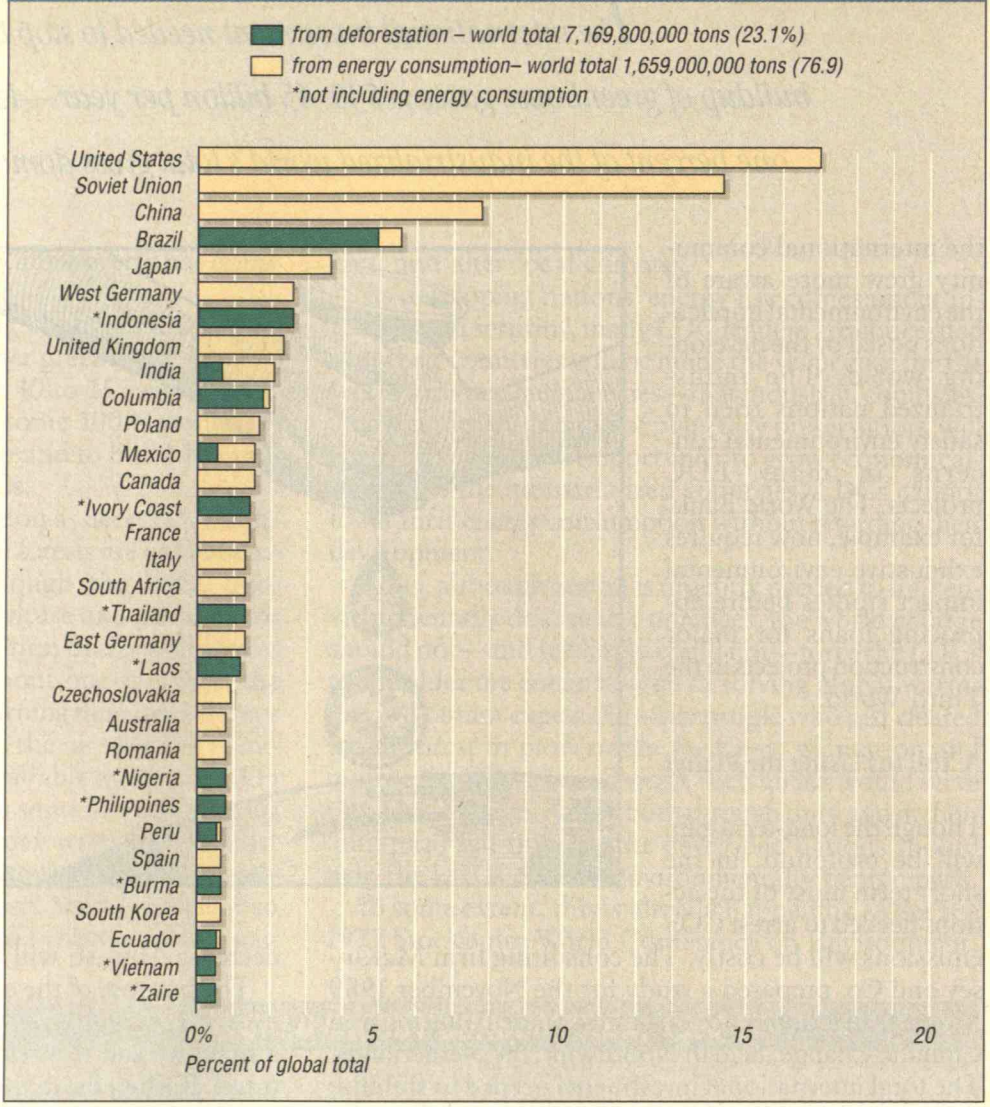
The tax would have to be collected at the source, as an increase in the price of oil, coal, and gas. The pool of revenue would be allocated to LDCs by existing United Nations organizations—such as the UN Development Program and the UN Environment Program—or by the World Bank. Some have also suggested creating a new agency specifically for this purpose.

These organizations would, for example, extend preferential financing to projects that are energy-efficient according to standards of industrialized nations. This policy would not only avoid future expensive retrofitting but induce savings in energy consumption. Commercial international banks would hardly find such schemes interesting.

Suppose a new refrigerator factory is built in Brazil. Banks could offer low-interest loans on the condition that the factory must be tooled to produce models that consume at most 400 kilowatt-hours a year—half the power used by the standard Brazilian refrigerator. If the company sells 1 million units each year, this will represent annual savings of 400 million kilowatt-hours.

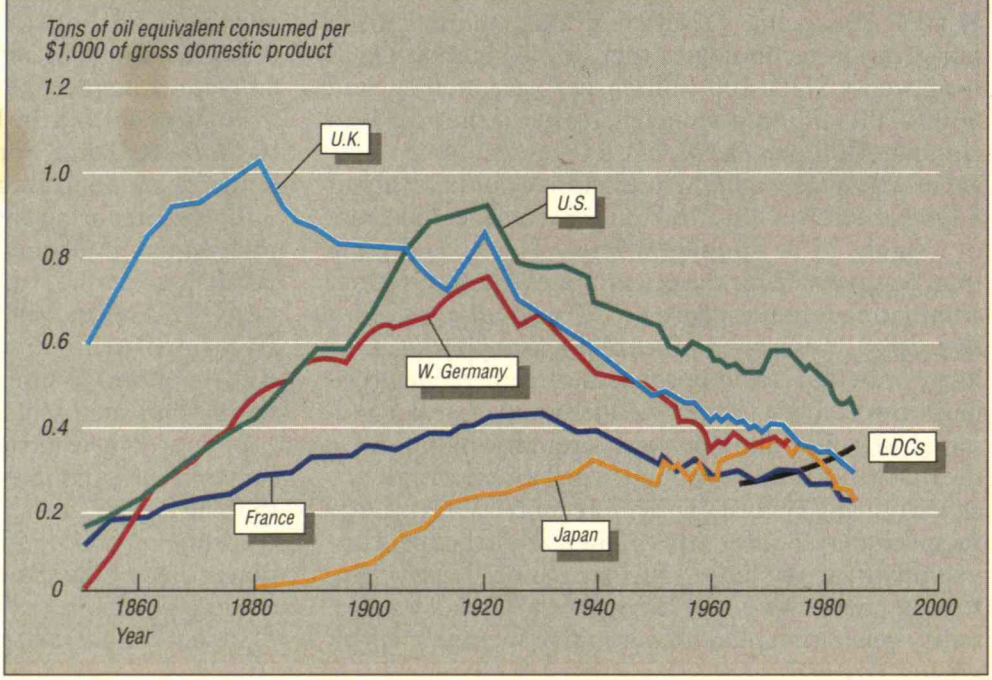
*Responsibility for stopping global warming is widely distributed among nations. In general, industrialized nations produce $CO_2$ mainly through energy consumption, while developing countries contribute principally via deforestation. A carbon tax would raise money from the energy consumers to pay for (among other things) replanting the burned forests.*

## CARBON EMISSIONS BY COUNTRY




*Energy intensity has been steadily declining for decades in the industrialized world. Each nation hits a peak during the relatively brief period when it puts in place an industrial infrastructure. This undertaking demands huge amounts of energy-intensive materials such as wood pulp, paper, chemical fertilizers, hydraulic cement, steel, copper, and aluminum. Once the infrastructure is built, economic activity moves toward services, which use less energy than manufacturing. The later a country develops, the more efficient are the manufacturing methods and transportation systems it adopts—and hence the less accentuated is the peak in its energy intensity.*

## EVOLUTION OF ENERGY INTENSITY



*A carbon tax may not be politically feasible in many countries right now. But attitudes are changing as people absorb the implications of inaction.*

Such a reduction would avoid the need for 35,000 kilowatts of generating capacity—an additional economy of at least $70 million. A similar condition could apply to factories that produce automobiles and other products essential for development.



### Technology Transfer

Effective though a carbon tax might be, it will take more than money to assure that the LDCs choose the path of environmentally sound development. These countries are, almost by definition, going through their infrastructure-building stage—a period that historically has meant intensive use of energy. But the industrialized world can make sure that advanced technologies reach developing countries at a relatively early stage of their economic growth. With access to new, more efficient machinery and techniques, the LDCs can attenuate the inevitable spike in energy use.

Technology transfer is particularly important for reducing CFCs. Some developing countries, including India, refused to join the Montreal Protocol on the grounds that CFC substitutes are too expensive. It would be in the interests of the industrialized countries to give such countries, at no charge, the technology for phasing out CFCs. Each developed country would have to establish its own internal mechanisms, such as tax exemptions, to compensate industries for their costs.

The industrialized nations could also subsidize the LDCs directly. This was the process agreed upon in June, when 93 nations, including China, India, and other LDCs, promised to halt production of CFCs by the end of the century. The industrialized countries committed about $300 million to this effort.

In some cases, simple technologies would go a long way. In Africa, the introduction of gas and kerosene stoves would tremendously reduce the incentive to cut down trees for fuel wood. From this standpoint, efforts by some environmental groups to optimize fuel-wood cooking stoves are grossly misguided.

### Environmental Realpolitik

Because the scheme proposed here conflicts with some established interests, it is unlikely to be accepted immediately. One serious problem is that most of the funds raised by the carbon tax would have to be distributed not as loans but as outright grants. Institutions such as the World Bank that would provide the financing are not in the habit of giving money away, but lending makes no sense when the project being funded has no near-term economic payback. Neither the replacement of CFCs nor the reforestation of cleared land will reap a return in a time frame meaningful to financiers. Energy-efficiency measures, in contrast, do have a tangible and predictable payback, and thus are suited to loans.

Admittedly, a carbon tax and increased regulations may not be politically feasible in many countries right now. But attitudes are rapidly changing as people absorb the implications of inaction. In the United States, the impetus might come not so much from Washington as from localities such as smog-choked California, which tends to impose pollution controls before the rest of the country.

Given the high stakes, an internationally agreed-upon tax is not a very radical step. Cooperation among rich and poor nations will be based not purely on goodwill and philanthropy but also on enlightened self-interest. The sums of money needed to stabilize the atmosphere are not really that large: $50 billion represents 0.4 percent of the total gross domestic product of the industrialized world. Spending such a sum to stabilize the atmosphere and avoid environmental catastrophe seems a prudent—and, in the most basic sense, conservative—proposition. ■

# Setting a New Agenda for



# Global Arms Control

## An Interview with Randall Forsberg



**The founder of the movement for a nuclear weapons freeze says the world has a choice: arm to the teeth or move to a demilitarized security system.**

ON June 12, 1982, a group on the order of 1 million people gathered in New York City's Central Park to call for a freeze on production of nuclear weapons. The inspiration for the freeze movement, and hence for the rally—the largest ever held at the time in the United States—came from an essay written by Randall Forsberg in 1979. In the piece, she proposed a step-by-step approach to disarmament, starting with a nuclear freeze by both the United States and Soviet Union.

During much of the 1980s, it hardly looked as if the U.S. government was interested in relaxing its militant stance toward what Ronald Reagan dubbed the "evil empire." But with Mikhail Gorbachev's advent, even Reagan began talking about eliminating nuclear weapons. By last November, Forsberg found herself—along with other experts—briefing George Bush for his year-end Malta meeting with Gorbachev.

Now, as the superpowers negotiate treaties on both nuclear and conventional weapons, a question arises: What should be next on the world's agenda? Forsberg, director of the Institute for Defense and Disarmament Studies (IDDS) in Brookline, Mass., says that military forces have to become truly defensive.

Forsberg isn't the typical person one expects to see at arms control seminars, a world dominated by men. Many of the experts appear to focus so much on details of strategy and weaponry that they lose sight of the larger goal—a lasting, demilitarized peace.

Randall Forsberg can sling numbers on missile throwweight with the best of them. Yet she manages to bring talk around to the underlying issue: moving beyond militarism. Precisely because of her interest in the long-range focus, in 1979 Forsberg purposely founded IDDS outside of Washington, D.C. "People in Washington tend to be very short-term in their view of what is interesting and what is possible," she told *Technology Review* managing editor Sandra Hackman and senior editor Laura van Dam in a recent interview at her office. "In the late 1970s, we had actually seen 25 years of people in Washington trying to get government to cut back on nuclear weapons production without succeeding. People did not believe that a demilitarized foreign policy could ever work, or that the United States could play a role in leading the other industrialized countries toward a demilitarized world."

In recent months, of course, the United States has taken the primary role in opposing Iraq's takeover of Kuwait. While Forsberg thinks U.S. intervention was unavoidable in this case, she says a far better scenario would have developed if the major industrialized nations had previously worked out a cooperative scheme for responding to aggressive activity by other countries.

Forsberg has been in the arms control field for more than two decades, mixing analysis and activism. She worked at the Stockholm International Peace Research Institute from 1968 to 1974, then spent several years studying for a political science doctorate at MIT before starting IDDS. Now Forsberg is completing her thesis while trying to convince the world to take a new approach to defense.

PHOTOGRAPH: RICK REINHARD/IMPACT VISUALS

TR: Where do you think the enormous changes in the Soviet Union and Eastern Europe will lead us?

FORSBERG: It is wonderful that we are starting to recognize that we need not always have enemies. But in many ways we're not rising to the occasion. In fact, we are on the verge of making a terrible mistake. The large industrial countries are continuing to produce weapons that they no longer need for national security. Governments have always justified large standing forces on the ground that they could be used against one another. We do not need them for the kinds of conflicts that are likely to occur in the future.

TR: What level of defense do we need?

FORSBERG: What the United States and the other industrialized nations need is a true defense system, what many people call "non-offensive defense." In other words, no country should be able to operate large military forces effectively at a significant distance from its borders. With such a defense, nations would maintain not ocean-going navies but coast guards, not long-range air forces but air defense systems. And they would not have armies that can be shipped around the world, but border guards and the equivalent of the U.S. National Guard—domestic peacekeeping forces.

This proposal may seem extreme, but I am thinking of moving toward non-offensive defense gradually. I am not describing the forces we should maintain this year or next, but those we should have in a decade or two. We cannot and should not change political and social institutions overnight.

TR: Aren't there occasions when morally a country may do the best thing by going beyond its own borders to help another country, such as Kuwait?

FORSBERG: Certainly. But the question is who should do the intervening, particularly in the Third World. Since World War II it has become more and more unthinkable for the industrialized countries in the Northern Hemisphere to go to war with one another. The stakes have become too high. Moreover, the industrialized countries are moving into an environment in which all real competition and cooperation will be economic. No military or political leader can foresee a situation in the next several decades in which any of these countries—the United States, Soviet Union, Japan, Canada, or the European nations—would seriously consider going to war with one another.

Then there is the Third World. Three kinds of issues have been used to justify intervention by either of the superpowers there: resources, strategic footholds, and the form of government. But after Vietnam and Afghanistan, people in the industrialized countries no longer want to try to influence the form of government or economic system in a Third World nation by sending large numbers of young men to die in civil wars. The end of the Cold War has reinforced this, and further reduced the need for strategic footholds.

That leaves access to natural resources as the only potential reason for large-scale intervention in the Third World. Yet no resources are so important or valuable that they could begin to justify annual U.S. military spending of $300 billion.

TR: What about oil and Iraq?

FORSBERG: Middle Eastern oil is the one resource where the stakes bear some relation to the cost of U.S. and other Western military forces. But even in this case there is a tremendous disparity between the current crisis and the long-term policy choices that face the Western world.

Iraq should not be allowed to take over Kuwait, much less to control all the oil coming out of the Persian Gulf. But the world would be in a far better position to prevent or, if necessary, reverse an aggressive action like Iraq's if the United States, Soviet Union, and other large Western nations followed a few simple guidelines for demilitarizing international affairs. First,

**No country should be able to operate large military forces at a significant distance from its borders.**





PHOTOGRAPHS: STU ROSNER

they need to stop exporting major weapons to the Third World. Also, as a matter of principle, they need to consistently and strictly oppose military aggression, without regard to national interests. In the event of such aggression, they need to be able to send in a strong multilateral peacekeeping force, with contingents from many nations. This can work even with a policy of nonoffensive defense, since the size and makeup of the international force would be significant relative to the aggressor's forces. Finally, the industrialized countries need to end their unilateral interventions in the Third World.

If such guidelines had been in place, Saddam Hussein's armed forces would have been limited and he would have known the world would not accept his move into Kuwait. And if the forces responding to Hussein were truly multilateral rather than being mainly American, Arabs in Iraq and elsewhere would be much less prepared to back him.

This conflict illustrates the fact that we face a basic choice. We can have policies that will prevent and defuse such crises while promoting the growth of democratic values and institutions. Or we can have policies that encourage endless repetitions of dangerous, destructive confrontation.

### Better Off with Fewer Armaments

TR: Could nationalist movements in Eastern Europe and the Soviet Union pose a threat to Europe or the United States?

FORSBERG: I don't believe Eastern Europe will break up. But there is the potential for very strange and frightening forms of instability in the Soviet Union. We'd be much better off in that kind of future if there were a lot fewer armaments around. Having the Soviet Union and NATO maintain several thousand supersonic airplanes will not help either side deal with riot control in the Soviet republics.

Even if there were a coup in the Soviet Union, that would not pose a risk of conventional war in Western Europe. No informed military person here has argued that. The Soviet military has already gone too far toward pulling back from Europe. By 1993, without support from the United States, Western Europe's ground and tactical air forces will outnumber their Soviet counterparts. This will be the result of the breakup of the Warsaw Pact and the first treaty on conventional forces in Europe (CFE), to be signed this fall. By 1994, when the last Soviet troops leave what was East German territory, there will just be no way the Soviet Union could attack in force or with short warning.

**Without deeper reductions in nuclear weapons, a coup or chaos in the Soviet Union could be very dangerous.**



Without deeper reductions in nuclear weapons, a coup or chaos in the Soviet Union could be very dangerous, however. This, of course, has nothing to do with the level of U.S. military spending. The only way we can minimize the danger that nuclear weapons will be used is to preserve stability in the Soviet Union. And we should do everything in our power to help the Soviets make the transition to a functioning demilitarized market economy as quickly as possible.

That brings me back to what we have to do in the Third World. Our greatest interest there lies in preventing the proliferation of nuclear and conventional weapons—the weapons that could, as in Iraq, become our future threats.

TR: What can we do?

FORSBERG: The wealthy industrialized countries are setting a bad example because we are still developing and manufacturing vast numbers of nuclear weapons while we tell other countries they shouldn't acquire any nuclear weapons. Third World countries think this is discriminatory, and that they need not accept it.

Also, we could have a much more stringent nonproliferation regime. As part of that we could use economic aid and sanctions to stop the spread of nuclear weapons. I believe that if we took such actions things could actually turn around to the point that the spread of these weapons in the Third World would end.

TR: Isn't it too late? Some Third World

countries have nuclear weapons and could use them.

FORSBERG: That is one reason demilitarization in the industrialized countries must happen gradually. The United States and Soviet Union must keep some nuclear weapons until there has been an extended period in which we no longer feel the need for them. In other words, we may need to keep a minimum nuclear deterrent of a few hundred weapons each for the indefinite future.

Of course, we have to recognize that any country that gets nuclear weapons can put one on a commercial ship or aircraft and bring it into any major city. We have no defense against that. The only defense we have against nuclear destruction is maintaining an understanding of the importance of never using these weapons.

Ultimately, nothing can provide an ironclad guarantee that no Third World country will make war on its neighbors. All we can do is try to reduce the possibility. If we move toward a more peaceful international system, the problems of armed conflict will become fewer, smaller, and more manageable.

TR: But won't economic competition push corporations and countries to keep arming Third World countries?

FORSBERG: Yes, especially as demand for military production in the United States, Europe, and the Soviet Union drops. In fact, the specter of massive unemployment in the high-tech defense sector may, more than any other factor, perpetuate a huge military system around the world.

TR: How do we get out of this trap?

FORSBERG: Through a major conversion program. We must have federal legislation to provide such a program. Our immediate choice isn't whether to put the money saved from military reductions into cutting the deficit or financing other government programs. First we have to put the money back into the communities that have supported major military production for decades. They need funding for an extra year or two to get on their feet in a new area. The conversion program should include capital-investment tax breaks for companies that re-employ workers laid off from military production, as well as assistance in retraining workers and subsidies for relocation costs.

**The specter of massive unemployment in the defense sector may perpetuate a huge military system around the world.**



TR: In a sense, you're talking about a post–Cold War GI Bill.

FORSBERG: That is a good way of putting it. It is a way to get a peacetime economy off to a good start. We did that with the Marshall Plan in Europe and with subsidies for the defense sector in the United States. The idea that the country cannot afford 18 months of assistance to civilian industries is penny wise and pound foolish. Without a conversion process, we'll just keep paying for unnecessary military production for years.

Of course, even if every industrialized country shut down its factories for making high-tech weapon systems tomorrow, that would not end all growth of Third World military forces and industries. But many Third World countries, if not all, would change their view of how to approach international conflicts. The environment for peaceful conflict resolution would be greatly improved.

### What Happened to the Freeze Movement

TR: One group that might be expected to play a role in these changes is the movement to freeze nuclear weapons. But despite its enormous popularity in the early 1980s, it doesn't seem to be very prominent these days. What's happened to it?

FORSBERG: In 1984 the Democrats were handed this issue on a silver platter, but they lost it by giving only lip service to the freeze. In the televised presidential debates, people could see that Mondale was not serious in his support for the freeze, whereas Reagan had total conviction about his policy. People in the freeze movement were so

disappointed and discouraged they lost their drive.

Still, it's not surprising that the peace movement is not out in the streets just now. The goal of the vast numbers of people calling for a freeze in the early half of the 1980s was to move away from the arms race as the basic form of relationship between East and West. That goal is being fulfilled now. There are times when governments feel popular pressure, and times when the authorities have to respond to those sentiments. We're in a response period now.

Of course, the U.S. government is also responding to the phenomenal changes in the Soviet Union and Eastern Europe. But those changes are not unrelated to the freeze movement. The people working for independence in Eastern Europe and the liberal intellectuals who are now leading the Soviet Union share the values of the anti-nuclear and peace movement in the West.

TR: Are we approaching a nuclear weapons freeze?

FORSBERG: Yes, I think we're getting closer to that goal. I've been heartened that on two occasions in the last year congressional committees have blocked funding to build plutonium production reactors for making more nuclear weapons.

Moreover, the Strategic Arms Reduction Treaty (START) now under negotiation calls for a modest reduction in long-range nuclear weapons. The United States is also negotiating on or unilaterally pulling back some of the short-range missiles that could have formed a nuclear tripwire in an escalating European conflict as well. I understand the U.S. Navy is withdrawing all short-range nuclear weapons from ships. So we are approaching the time when the production of nuclear weapons will stop, perhaps by the end of this decade.

TR: Given that, do you think that public involvement in disarmament matters anymore?

FORSBERG: Public concern and pressure is still important. Although George Bush has had a broader arms control agenda than any previous U.S. president—his administration is negotiating nuclear, conventional, and chemical treaties simultaneously—almost all the cuts have been on the Soviet side. When I spoke with President Bush last November, I felt it was important that both sides make deep cuts in conventional arms as quickly as possible, to keep progressive change in the Soviet Union moving forward. The administration has kept to a tight timetable in the CFE talks—but it has shown incredible foot-dragging on U.S. reductions. While the Soviet Union will reduce its army by more than half in the next three years, the United States will merely pull out 50,000 to 100,000 people from Europe—2.5 to 5 percent of what we have globally. There will be no significant U.S. air force reductions as a result of the CFE treaty. And the West has refused even to discuss naval reductions.

**By the turn of the century, Japan will have mastered all the technologies of a military superpower.**

The other big issue for the public concerns Japan, which is in the middle of a military buildup. The U.S. government has been encouraging Japan to spend more on its military. At the same time, the Japanese have been developing an independent production capacity in every kind of military system. They started building tanks in the 1950s, naval ships for use around Japan in the 1960s, and missiles in the 1970s. Now they're moving into advanced military aircraft. They have a space program that requires launchers that are equivalent in size to ballistic missiles. And within a decade Japan could acquire nuclear weapons, if it decided to go that way.

In other words, by the turn of the century Japan will have mastered all the technologies of a military superpower—and it will have developed this strength without the distorting allocation of resources we have experienced in the United States. Japan has been spending about 1 percent of its gross national product on the military for 20 years. Today that translates into $35–40 billion, an order of magnitude less than what the United States spends on defense. But in a decade, with the Japanese GNP probably growing at 5 percent a year, 1 percent will mean $70 billion. That will buy

a couple of aircraft carriers plus escort ships and a long-range air force. That wouldn't give Japan the whole panoply, but it would provide more "power projection" than any nation except the United States.

**TR:** What's pulling Japan in this direction?

**FORSBERG:** An archaic approach to foreign policy. For the last 40 years, primacy of place in the international community has been given to the United States and Soviet Union simply because they have been military superpowers. Japanese leaders may think, "If that is what it takes to be recognized as a first-class citizen of the world, then that is what Japan will get."

**TR:** How do you envision stopping this trend in Japan, and turning things around in the United States?

**FORSBERG:** First we need to focus on the amount of military spending in the United States. The public's attention on our military budget will really grow between 1991 and 1993, when the Soviet Union starts destroying all sorts of military equipment to comply with the CFE treaty. The USSR will crush, blow up, or melt over 100,000 aircraft, artillery pieces, tanks, and other armored vehicles.

In fact, the Warsaw Pact nations have had to extend the deadline for implementing the treaty because they think the destruction may take longer than three years. An East German diplomat told me a test indicated that using welding equipment to cut artillery guns in half would require East Germany's entire welding capacity for a year. (They decided not to use that process.)

In January, the Western news media will start showing scenes of Soviet tanks being blown up and helicopters being crushed. The impact on the public will be substantial, especially as the destruction goes on and on and on. If people learn that the United States is not destroying conventional forces—just building more—a public debate will ensue.

**TR:** Won't Americans develop the same kind of fear and anger about a military build-up in Japan that we've had about its growing economic strength—and therefore want to maintain our military force?

**FORSBERG:** That could well happen if the U.S. military uses these developments to raise the specter of renewed Japanese aggression. There are already signs that the cultural antipathy could get very ugly.

Preventing that is not just a U.S.-Japanese issue. International demilitarization will require a new kind of organization that involves people from the Soviet Union and Europe as well as from the United States and Japan. Such a group must engage influential elites as well as activists. Political leaders in Europe are already moving toward the view that they must invest their resources in growth and the environment, not in militarization that will only bollix up the works.

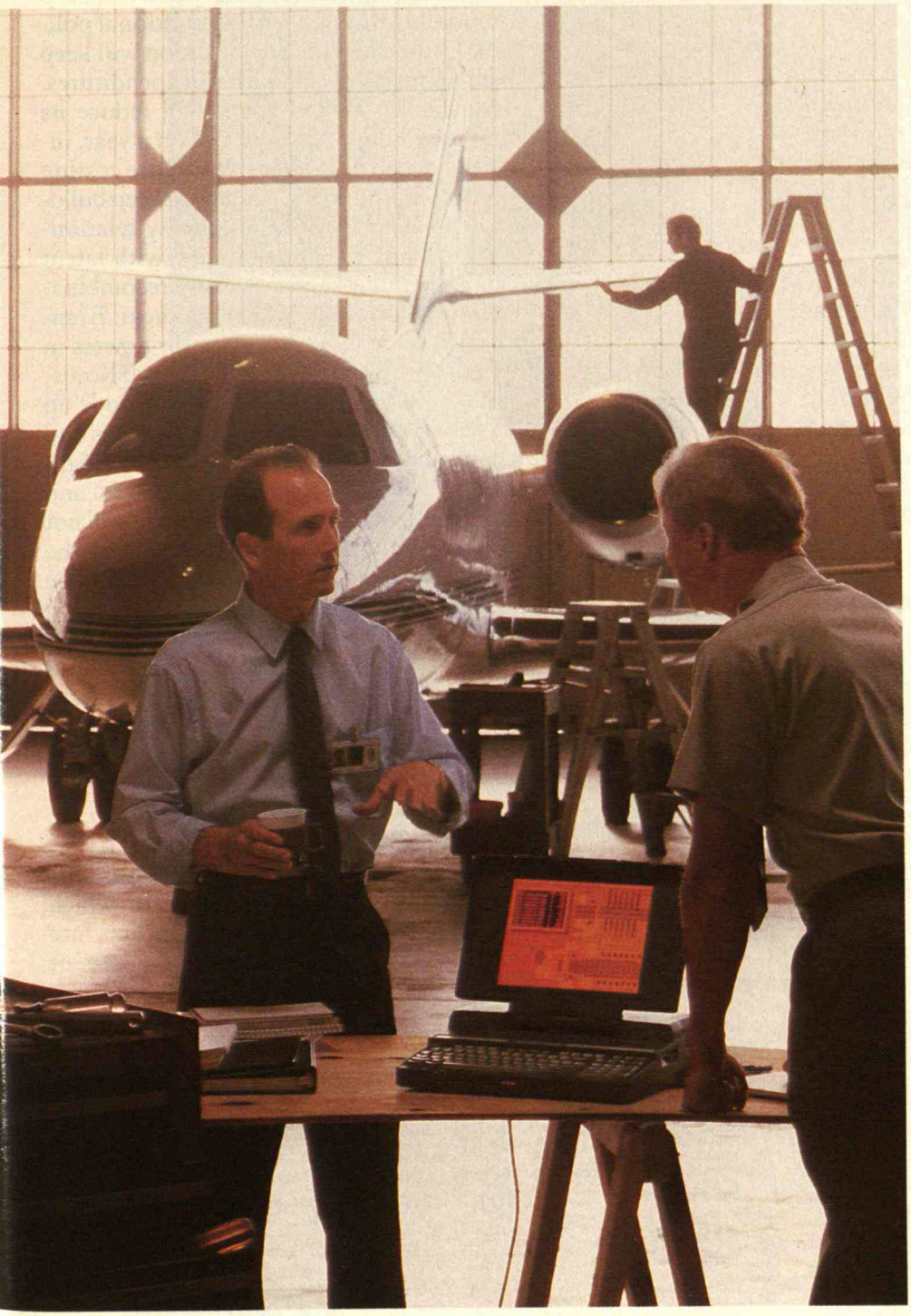
**TR:** What timeframe do you see for an international movement for non-offensive defense?

**FORSBERG:** A popular U.S. campaign to cut military spending could emerge in '93 to '95, and develop into support for non-offensive defense in the latter part of the '90s. By then it will be important for the wealthy nations to shift out of the old power-politics system with supersonic aircraft and aircraft carriers as crown jewels and move toward a demilitarized security system.

At that time, the debate will be shaped by developments in Japan and Europe. Japan will be starting to acquire aircraft carriers or other ships it could send into the Persian Gulf. Meanwhile, if the process of arms reductions with the Soviet Union keeps going, England, France, and Germany may have made overall cuts of 50 percent in their military budgets. They will no longer be able to maintain separate production lines for weapon systems, but will be considering a pan-European defense industry. That is the moment when the United States, Soviet Union, Europe, and Japan together will decide if they want to keep

**International demilitarization will require a new kind of organization that involves the Soviet Union and Europe as well as the United States and Japan.**

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producing weapons we do not need and exporting them to the Third World.

### Has Deterrence Worked?

**TR:** You have this vision of a group of largely demilitarized, powerful countries. But isn't it possible that deterrence has worked? Have we perhaps needed the arms race to bring us to this point?

**FORSBERG:** We can never know whether deterrence has worked. Until 1945 countries considered it normal to go to war when they thought it would be to their advantage. To imagine such thinking simply vanished in 1945 and nuclear weapons had nothing to do with the change seems farfetched to me. I believe fear of nuclear war has played a significant role in the widespread feeling that another war like World War II cannot occur.

However, there are other reasons a world war has seemed unlikely, and no one can really say where the balance lies among all the reasons. For example, there has been such rapidly rising wealth in the industrialized countries since 1945 that for the first time in history they have had far more to lose in a war than they could gain. Also, modern communications have made it increasingly difficult to mobilize people to see others as enemies.

Even though nuclear weapons have helped make war less likely, they are reprehensible because they are weapons of genocide. Threatening genocide and global destruction has become a cornerstone of our means of preventing war. That is grim, primitive, and in the long run surely not right or necessary.

Certainly we do not need the present degree of military buildup to learn how to live together. We have wasted billions of dollars and created enmity where it need not exist. Sadly, it is also possible that the arms race has contributed significantly to the Soviet Union's virtual bankruptcy.

**TR:** How much of your ambitious plan do you think will be realized?

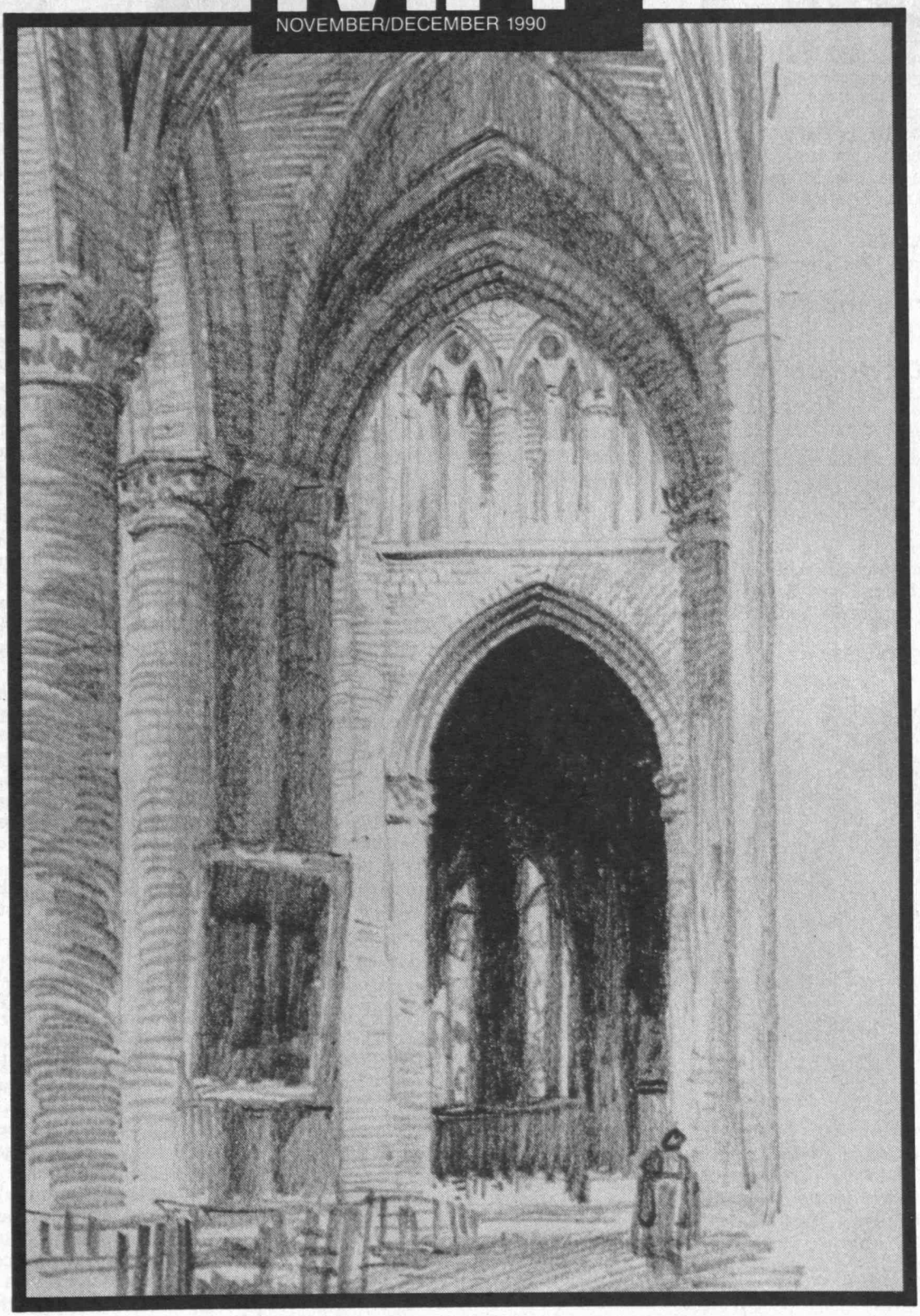
**FORSBERG:** The most likely outcome over the next decade is that the world will keep muddling through with an irrational policy. Europe and the Soviet Union will keep cutting back their military expenditures. Maybe the United States will reduce its military budget to $200 billion a year, instead of to a non-offensive defense costing $50 billion annually. Japan will keep building up. There will be an uneasy relationship among the great powers, with latent military threats and successive recombinations of power blocks among them. Eventually, there will be new major powers in the Third World, like China, South Korea, India, and maybe Brazil. All this adds up to a world with many military powers and continued production and spread of high-tech weapon systems that are wasteful and that exacerbate fears. This scenario will not be as costly and confrontational as the worst one I can imagine, but it will still be a version of the old hegemonic system.

It's less likely that the leaders of the great powers will exercise the imagination and effort needed to create a demilitarized security system. But either way, by the year 2050 people will probably live in a world with little or no warfare. It could be a precariously balanced world, in which there are tremendous chances for collapse into war, with weapons of global reach available everywhere. Or it could be a world in which arms are minimized and conflicts are resolved without threats of the use of force. ■

**Certainly we did not need the present degree of military buildup to learn how to live together.**



MIT
NOVEMBER/DECEMBER 1990



*Lawrence B. Anderson, '30: Artist, Educator, Architect*

An Exhibit at the Compton Gallery

MIT
NOVEMBER/DECEMBER 1990

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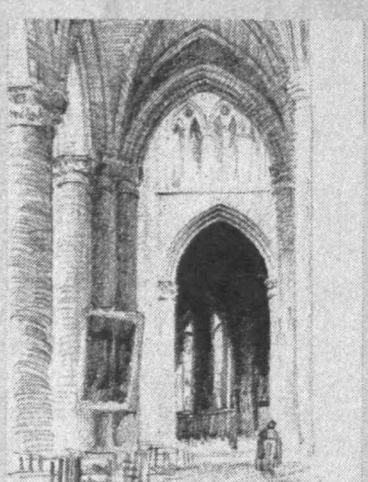
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**COVER**
***An exhibition celebrating the distinguished career of Lawrence B. Anderson, '30, former dean of the MIT School of Architecture, is on display in the Compton Gallery through December 14. Compiled by the MIT Museum, "Lawrence B. Anderson: Artist, Educator, Architect" includes building plans, Beaux Arts renderings, and watercolor landscapes. Anderson received the Boston Society of Architects Award of Honor in 1984. Photo: L. Barry Hetherington***



# LETTERS

*Wow. It's dangerous to mess with a time-honored and much-loved institution. And by all accounts, Puzzle Corner is just that. Our proposal to eliminate Allan Gottlieb's column to make room for additional Institute news and information that we've been asked to provide met with fierce and loyal opposition.*

*We confess that we were not fully aware how strongly readers (and puzzlers) felt about the entertainment and challenge Puzzle Corner provides—not to mention the pride in MIT's difference that it represents. But we are not entirely lacking in either heart or brains, as some of the more irate letter writers seem to have thought. We hear you, and we do understand (now) why Puzzle Corner is important.*

*So it shall return—posthaste, or as soon as Allan can regear. He has kindly consented to continue putting together the column and has graciously agreed to the modifications deemed necessary to fit Puzzle in with the other demands for space on our pages.*

*Beginning in January 1991, Puzzle Corner will appear in* Technology Review *in a slightly altered format. It will occupy one full page and consist of 2 to 3 puzzles, a speed problem, and the answers from the third issue previous. The emphasis will be on original or MIT-oriented problems, but the mix will be similar to what it has been in the past. To conserve space, lengthy solutions (e.g., ones involving extensive computer programs) will have only their short answers printed; in such cases, the full solution will be available from the editors at* Technology Review.

*We thank everyone who took the time to express their feelings about Puzzle Corner. Below are excerpts from a few of the many letters we received.*

I read with dismay that Puzzle Corner is being dropped from *Technology Review*. I feel this is a mistake in the long run. Not only have I enjoyed the diversion of the puzzles that Allan Gottlieb has presented, but it has also prompted me to let *TR* hang around a little longer on my desk. While cogitating on the problems, I read a few more articles. Please reconsider your decision to drop one of the best parts of the magazine to save a little space. . . .

MARLON K. WEISS, '80
Wichita, Kansas

. . . [T]he reasoning] that there are other publications offering mathematical problems is like saying there are other institutions besides MIT that offer technology-oriented education. Using the same logic, if MIT were shut down, students could just go elsewhere. The fallacy is that MIT is a one-of-a-kind institution; so is the Puzzle Corner. Its personal touch, devoted reader base, and unique mix of problems can *not* be found elsewhere. Allan Gottlieb's distinctive editorial imprint makes this a column the popularity of which I feel you are grossly underestimating. . . .

STEVEN A. FELDMAN, '79
Framingham, Mass.

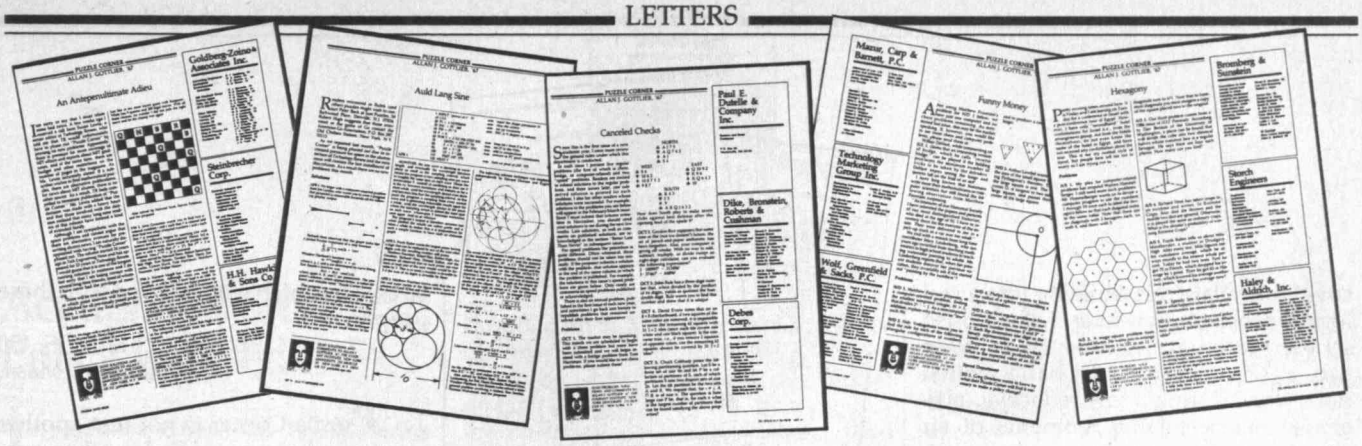
. . . I know I can buy books of puzzles (and I do sometimes), but looking at puzzles in my alumni/ae magazine takes me back to my undergraduate days in ways that a book does not. I know that makes little sense, but then emotions seldom do (and after all, emotions are at the bottom of why we donate to MIT and read *TR*!).

But don't get me wrong. If you indeed cancel Puzzle Corner, I'll still donate to MIT (the same amounts I would have anyway) and I'll still read *TR*. I'll just grieve a little bit about the way rational decisions always seem to pick away at the little things that we irrational humans find link us to our pasts. . . .

MICHAEL KRASHINSKY, '68
Scarborough, Ontario

. . . Bad mistake to axe Puzzle Corner. The success of alumni magazines is not due to the obvious (more coverage of MIT affairs and alumni/ae) but to the awareness of who the alumni/ae *are*. They are, by and large, people who enjoy a thoughtful puzzle corner. They would not necessarily wish to subscribe to a publication solely for that purpose. You can take only so rich a diet of "MIT.". . .

ROGER L. BURNLEY, '60
(not a puzzle addict)
Edinburgh, Scotland



. . . I am a mathematical klutz. It took me until my senior year at MIT to pass 8.02, the second semester of freshman math. Nevertheless, Puzzle Corner has been, for the last 20 years, consistently one of the first things (often the first) I turn to in *TR*. I ignore the problems that require calculus and concentrate on those that can be "puzzled" out. In all this time I have only once sent in a solution and gotten my name in print.

In short, I represent the unlikeliest candidate for a Puzzle Corner devotee you are likely to find.

My guess is that since the same short list of people show up repeatedly as solvers of problems, you have concluded that only a handful of people read the column. However, if Puzzle Corner is of interest to me, a prototypical mathematical ignoramus, I would venture to suggest that it is of interest to virtually every *TR* reader.

If you do decide to keep Gottlieb, make him send you a new picture. The one you've been running for the last 23 years looks like it was taken when he was a senior in Baker House. . . .

MARTIN C. LANGEVELD, '70
Lanesboro, Mass.

*We did order a new photo, in late 1984—it seemed about time. He hadn't changed and still hasn't. Maybe there's a lesson here.—Ed.*

. . . I have great admiration for the quality and interest of the scientific articles and columns that you publish, but the Puzzle Corner has always been *TR*'s number one attraction for me. . . . For alumni like me, and I suspect there are many of us, the Puzzle Corner helps us to keep our math and logical faculties in good working order. . . .

THOMAS B. JABINE, '48
Washington, D.C.

. . . The Puzzle Corner reflects a lot of what MIT is about. It shows the attainment and respect for technical knowledge and reasoning over and above what our jobs will ever be about. Don't make the mistake of cloning our alumni section of *TR* to other alumni magazines. We are different. We are proud of being different, and this difference is reaffirmed by the existence of the Puzzle Corner. . . . THOMAS R. LEWIS, '63
Middletown, N.J.

. . . I understand that you plan to cancel Puzzle Corner. I'll get right to the point. Please don't do it. This column adds much more to my enjoyment of *TR* than an additional 10 percent more alumni news or Institute news could possibly add. . . . RICHARD M. KING, '72
Sunnyvale, Calif.

. . . I don't go out of my way to buy puzzle magazines, nor am I very interested in mind teasers. However, during the few times a year that I seriously attempt one of the problems in Gottlieb's column, I vicariously recall the all-night sessions in the Student Center coffee shop, the pages of false starts in a tough problem set, and graffiti that uses calculus. Also an incredible group of wide-eyed youngsters who tried to understand everything they could. . . .

FREDERICK M. RUST, '77
New York, N.Y.

. . . Your decision to terminate Puzzle Corner is itself a puzzle to me! I am sure if I were a more adept mathematician, I


OPPORTUNITIES MUST BE SEEN
TO BE SEIZED.






could formulate this situation into a real logical problem. However, I abandoned *serious* mathematics after 18.04, long ago. . . .Please excuse the hand-written note, done during a few reflective, otherwise puzzle-solving moments of air travel.

JERROLD L. ABRAHAM, '66
Fayetteville, N.Y.

. . . There is something nice about doing something active, albeit only attempting to work a puzzle, rather than just passively reading about others.

I am afraid that you will lose some goodwill among alumni/ae by dropping Puzzle Corner. The number of corresponding participants may seem small to you in proportion to the column inches the section occupies, but my impression is that there is quite a large number of alumni/ae who enjoy the column by trying to work the puzzles and by reading the published solutions without ever mailing in a solution to Gottlieb. Incidentally, Allan has done an outstanding job as editor over the years, which is obviously a labor of love. . . .

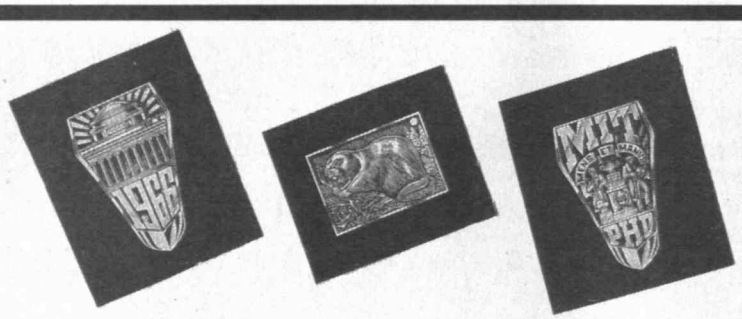
JOHN E. PRUSSING, '62
Urbana, Ill.

. . . I do not believe I could find [elsewhere] such unusual puzzles (and their solutions), the product of the fertile minds of our very own alumni/ae. Some of the puzzles have not been solved, even by their own proposers, until other alumni/ae work on them. It is a joy to be able to match wits at home with these people. . . .

EDWIN L. FIELDS, '50
Lexington, Mass.

. . . Puzzle Corner is not just another set of puzzles you can find in other publications. It is a *tradition*. The problems you find there are unique. They span a wide range of subjects—number theory, theoretical physics, chess, bridge, computer programming, tongue-in-cheek, and many more; nowhere can you find such a combination of captivating problems. And they sometimes require the knowledge you acquired at MIT, and other times they test your wit and instinct. I strongly urge you to reconsider your decision, and reinstate the Puzzle Corner to its honored position for the benefit of loyal, dedicated, and enthusiastic alumni/ae!

KEN HARUTA, PhD '63
Allentown, Pa.

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July 1, 1990

UNDER THE DOMES

# Academic Fraud Policy Revised

In response to new U.S. Public Health Service regulations, MIT has compiled an extensive policy on academic fraud and scientific misconduct with detailed procedures to follow if problems are suspected. The government's interest and involvement in scientific misconduct stems from the fact that it provides a substantial amount of research support to MIT through the National Institutes of Health, which is under the auspices of the Public Health Service.

In a memo to the faculty accompanying the revised policies, Associate Provost and Vice-President for Research Ken Smith, '58, said, "Until recently, it appeared that scientific misconduct was nearly absent from the academic research enterprise. As a consequence, the scientific community did not have well-established procedures for dealing with the problem. Worse yet, several recent cases have been both highly publicized and badly handled."

The official definition of "misconduct" or "misconduct in science," as set forth in the *Supplement to MIT Procedures for Dealing with Academic Fraud*, is "fabrication, falsification, plagiarism, or other practices that seriously deviate from those that are commonly accepted within the scientific community for proposing, conducting, or reporting research. It does not include honest error or honest differences in interpretations or judgments of data."

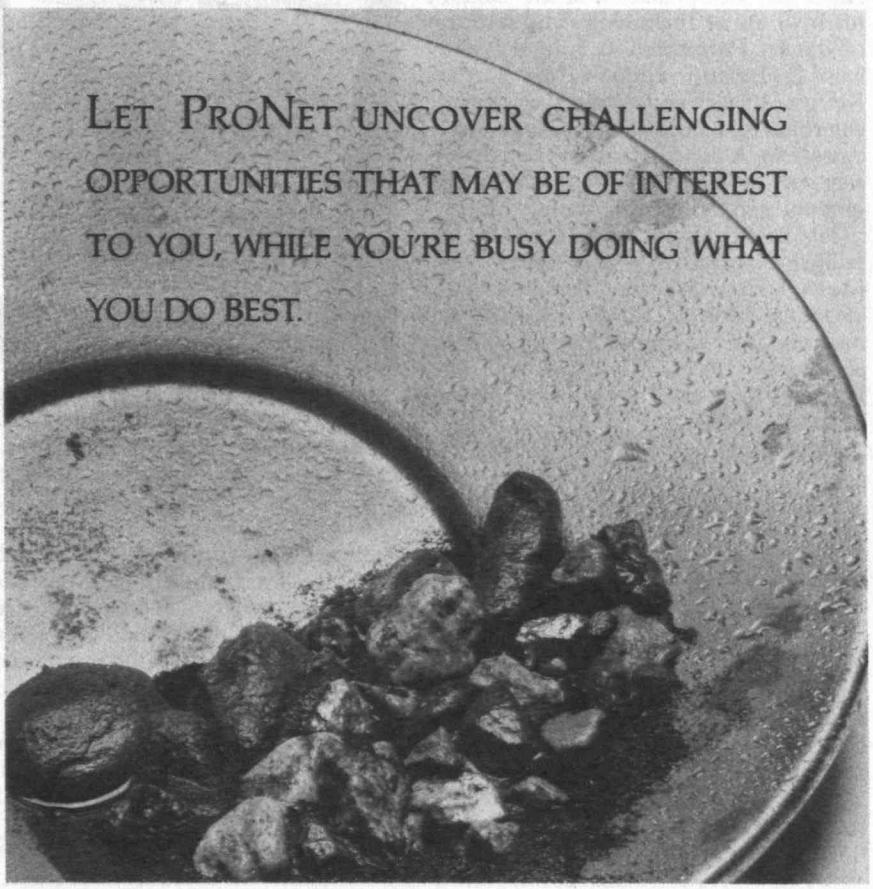
The new procedure for handling suspected fraud or misconduct consists of two steps—an informal inquiry and examination of the evidence, and a subsequent formal investigation if it seems warranted. Charlene Placido, assistant to the vice-president for research at MIT, explained, "Previously, the informal inquiry did not require written reports. In the revised policy, formal reports and documentation are required through all steps of investigation."

The most prominent case of suspected scientific misconduct in the last few years was the NIH and congressional-committee investigation of an article appearing in *Cell* magazine in 1986, written by six authors including then Assistant Professor Thereza Imanishi-Kari and Professor David Baltimore, '61, former director of the Whitehead Institute. Baltimore was cleared of the charge of fraud upon review of the material, and according to Smith, the revision of the MIT policy was not motivated by that investigation. He commented that although events might have run more smoothly, the old policy worked sufficiently.

Addressing the question of whether agencies such as the PHS should play an active role in university investigations, Smith said, "Most members of the faculty believe that this system works best when we keep our own house clean. The new policy recognizes that inquiries should start here in the Institute. PHS does reserve the right to intervene in the formal investigation process. But [that is because] other institutions, unlike MIT, have not done well on their own." □

# Deutch to Advise Bush Administration

John M. Deutch, '61, who stepped down October 1 as provost of MIT after five and a half years, has been appointed by George Bush to a two-year term on the President's Foreign Intelligence Advisory Board. An independent board, its function is to report on the "quality and quantity of the intelligence the president receives, as well as on the adequacy of the management and struc-



ture of the intelligence community." A member of the MIT faculty since 1970, Deutch will continue as the Karl Taylor Compton Professor of Chemistry.

As a consultant or advisor to six of the last seven presidents of the United States, Deutch has had considerable Washington experience. In 1961, while pursuing a doctorate in physical chemistry at MIT, he was also working in the systems-analysis group that brought civilian control and computer modeling to the Defense Department under Robert McNamara. In the Carter Administration, Deutch served as under secretary of the Department of Energy under James Schlesinger. Deutch is currently serving as a member of the Defense Science Board, the Defense Policy Board, and the Science Advisory Board of the National Security Agency.

In addition to Deutch, the Foreign Intelligence Advisory Board consists of Chairman John Tower, former U.S. senator; Vice-Chairman Bobby Inman, former deputy director of the CIA; Lew Allen, Jr., vice-president of the California Institute of Technology and director of the Jet Propulsion Laboratory; William G. Hyland, editor of the journal *Foreign Affairs;* and William J. Perry, chairman and CEO of Technology Strategies and Alliances, and former under secretary of defense for research and engineering in the Carter administration.

The first chairman of the Foreign Intelligence Advisory Board, under President Kennedy, was the late MIT president James R. Killian, Jr., '26, who had also served under Eisenhower as chairman of the board's predecessor, the Board of Consultants on Foreign Intelligence Activities. □

# Peacemakers For Hire

As disputes over public policies go, the debate on how to meet the nation's energy needs is a textbook case. Factions as diverse and powerful as the automobile, nuclear, oil, and coal industries, environmentalists, and proponents of alternative fuels have undermined each other for decades while the country's energy sources have continued to shrink.




Getting such disparate groups to even meet for discussion is difficult. Getting them to actually agree on a national energy strategy seems an impossible job.

But Larry Susskind, PhD '73, welcomes the challenge.

As director of the MIT–Harvard Public Disputes Program, Susskind has spent the past ten years fine-tuning the art of professional mediation and negotiation. Projects undertaken by the program run the range from settling local standoffs on prison overcrowding and public housing to devising more efficient federal regulations for settling land-use and environmental disputes. The PDP draws on the faculty and students of MIT's urban studies and planning department, where Susskind is a professor, and Harvard's law school.

"We help the different sides learn to be clearer about their underlying interests, then teach them how to invent options for mutual gain," says Susskind.

"Instead of insisting on an extreme position on every point, you break the issue into smaller parts. Then if you put enough issues on the table, each side can say, 'If you commit to A, then I'll submit to B.' Each side makes a commitment instead of hunkering down and saying, I'm stronger, I'll fight you."

In the case of formulating a national energy strategy, for example, he and his staff have been working for the past year and a half to find common ground for representatives of some several hundred formerly adversarial groups.

"The oil companies say, 'Let's drill in the Alaskan wildlife refuge.' The environmentalists say, 'No way, never, we'll fight you,'" Susskind says. "Through negotiation, the environmentalists can say, 'There are certain areas off the coast where we would support your drilling if you agree never to drill in the refuge.'"

After 10 years of mediating disputes at every level from local to international, Susskind can see a definite shift in the U.S. public-policy climate. Thanks partly to the PDP's newsletter, *Consensus*—which features successful cases of dispute resolution and which is distributed free to 23,000 public officials across the country—government agencies are more apt to seek professional mediation services these days instead of needing to be talked into such an approach. Two big incentives are time and money: Negotiation is a good alternative to "spending a couple years in court and not getting anywhere," he says.

Also changing is the definition of leadership in both the public and private sphere, he says. "You're much less likely to find leaders these days who decide on the right course of action, then knock heads to make it happen. Now an elected official will work to build a consensus among those involved with the issue."

Anyone interested in receiving *Consensus* or other Public Disputes Program publications can write or call the program, Room 3-411, MIT, (617)253-2026.—*Lisa Watts* □

# EECS Enrollment Begins to Balloon Again

Seven years ago the Department of Electrical Engineering and Computer Science at MIT found itself enrolling a record-high 35 percent of the sophomore class, or 380 students. Faced with severely strained resources—both academic and financial—drastic measures, such as a proposal to offer restricted admission (admitted without the option to major in Course VI) to a portion of the freshman class, were contemplated but eventually proved unnecessary and were abandoned with considerable relief. To ease the pressure, the EECS Department stopped accepting transfer students, and several other departments instituted new degree programs that included a hefty computer or electrical engineering component.

Enrollment in EECS steadily dropped each year until it leveled out at 169 students in the Class of 1990. Last year, the department began admitting transfer students again. After several years of manageable numbers, however, a Registrar's Office survey of freshmen last spring projects that approximately 32 percent of the Class of 1993, up from 27.5 percent the previous year, will major in EECS. Including transfer students, the enrollment could reach 345. However, EECS Head Paul Penfield, ScD '60, says the department has no immediate plans to take action, except to keep a close watch on the numbers.

Engineering as a whole drew nearly 70 percent of those who completed the survey. Mechanical engineering and aeronautics and astronautics were the second and third most popular choices after EECS. The School of Science attracted 21 percent, with physics, chemistry, and earth, atmospheric, and planetary sciences showing an increase over last year. A little under 4 percent indicated humanities and social sciences as their likely major; 3 percent picked architecture, 2.3 percent management, and .8 percent opted for brain and cognitive sciences. Approximately 14 percent of incoming sophomores did not choose a department in the survey. □

**CORRECTION**

## Management of Technology Celebrates Its Tenth

Due to a reporting error in the August/September "Under the Domes," the Management of Technology Program at MIT was mistakenly described as having just been launched. In truth, the 12-month program leading to a master of science degree has just admitted its *tenth class* of mid-career managers with science or engineering backgrounds. A decade ago the program became the first in the country to focus directly on the management of technology and the first of its kind conducted jointly by MIT's School of Management and School of Engineering. The curriculum was developed to help meet the growing worldwide demand for managers who can help bring advances in technology to the marketplace in the form of new products and processes. We regret subtracting nine successful years from the Management of Technology Program's history. □


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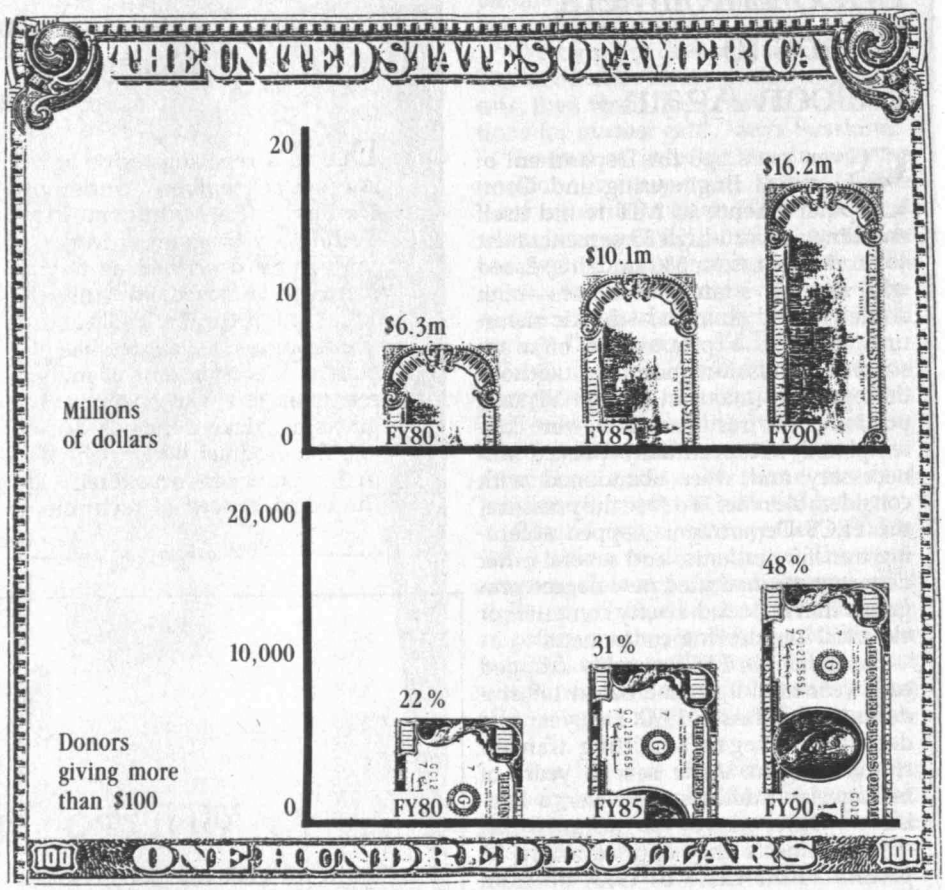
# Alumni Send Fund to All-time High

Donors gave in larger amounts than ever to push the 1990 Alumni Fund to $16.2 million, up $1.8 million from last year's total.

Contributing to the 1990 fund were 28,090 alumni, a record 48 percent of whom gave $100 or more. Their response pushed the Alumni Fund just inches short of its goal for the end of the MIT *Campaign for the Future* of a $100 median gift.

Much of that participation was spurred by a $1 million challenge grant offered by David Koch, '62. Alumni duly met Koch's challenge—to match 50 percent of any increase in giving on contributions of $100 or more up to a $1,000 limit per donor. Some 10,000 donors, more than a third of all 1990 contributors, earned challenge funds.

The effects of the Koch challenge should be felt for years to come, according to Richard A. Jacobs, '56, chair of the MIT Alumni Fund Board: "Once individuals increase their gifts from a minimum level such as $25 or $50 to a higher level such as $100, they tend to stay at the higher level."




Other highlights of the 1990 fund:

■ a total dollar increase of 12 percent from 1989;

■ a record $2 million in corporate matching gifts, up by 25 percent or $400,000 from last year;

■ gifts of $109,000 from close to 300 non-alumni parents, while the total received from all MIT parents in this first year of a Parents Fund totalled $235,000;

■ close to $12.5 million in unrestricted funds or gifts designated for the core needs of student financial aid and departmental support. □



*Under the sponsorship of the Western Returned Students Association pictured here—a venerable group whose origins predate the Chinese Communist Revolution—Zhang Quinnan, '51, recently organized the MIT Club of Beijing.*

BY LISA WATTS

# Priorities for the New President

Gather a handful of academic types to discuss an issue and they'll surely, as the saying goes, agree to disagree. Such was the case throughout the past year as the search for a new MIT president raised the inevitable questions about the Institute's future. Faculty members and alumni, independent thinkers by nature, voiced a wide range of opinions and concerns about where the school is going and what type of person is needed to lead it there.

Still, one consensus did surface: the Institute is due for a retooling. Faculty, alumni, and students agree that although the school's chief products—world-class education and research in science and technology—are fairly sound, the Institute's nuts and bolts—its curriculum, the teaching environment, and even its public image—could stand some updating.

To get a sense of the divergent views Charles Vest will face as he takes over the presidential office, *Technology Review* talked with ten faculty and alumni leaders. All agreed that MIT should take the lead in solving some of the country's big-picture technological problems such as cleaning up the environment and rebuilding U.S. industry. They all worried, too, about how to fund research as the federal government pares down its defense budgets.

Where they disagree is on whether or not to change certain long-standing MIT traditions. Among the questions: Should the Institute's undergraduate engineering degree be expanded to a five-year program, and should it offer broader exposure to the humanities and sciences, or should it stay as is? Should the Institute's first priority in recruiting faculty and students be to build diversity or to spark more state-of-the-art research in a variety of specialties?

Here, they share some of their views.



*Mildred Dresselhaus*

*Institute Professor*

*of electrical*

*engineering*

## MIT has a tradition of excellence in science and engineering, and the priority should be to maintain that.

It's always hard to maintain scientific excellence. Entropy makes excellence go toward the mean. At times we go out into broader and broader areas and try to become a general university, when we're better off being unique.

The electrical engineering department has an excellent reputation. We attract very good students; we put a lot of effort into teaching. I think other departments should do more in these areas. They should have to compete with electrical engineering, grab students away from us by providing good teaching and a good environment for students.

The president should pay personal attention to all new faculty appointments. If there's any indication our various schools are slipping in hiring the best in the field, he should encourage the search committees to be more selective.

Good hires take a lot of searching. You don't get that many unsolicited resumes—I've been on a lot of search committees. I hate to say it, but it sometimes does take the old-boy/old-girl network to identify the young stars. You have to call the leaders in the field, all over the country, and conduct a systematic search. That takes an awful lot of time. You have to decide what to cut out of your schedule to make room for the search.

Finding funds to support research is much harder now than it was 10 years ago. This discourages younger researchers. I can remember when I was a graduate student in the 1950s and most of the support was private. But since the time of Sputnik, the federal government has been encouraging science. It's difficult now to be on a downswing.

There are enough resources in this country to support research at universities. But funding decisions are a question of priorities. The money being spent in R&D isn't always being spent in the best way, because small science—an individual investigator and his or her students—often gets overlooked. The small science community is rather ineffectual in making its case for funding. We don't have the single voice that large science has.

If the next president can provide inspiration and leadership in helping smaller projects be funded, that would be a great help. He should develop a strategy for this, then work individually or with presidents of similar institutions to develop a solution to this funding problem. [Under funding of small science] is quickly becoming a crisis because young people just aren't going to enter the field.

Women have been making important contributions at MIT and I would like to see this continue. Career paths aren't always the same for women. We don't know why—maybe it's cultural—but women will take different approaches in looking at a research problem, even in selecting a problem. And women have different constraints. We have a lot of faculty here with families, and the semesters when the baby comes are always a little tougher for women than they are for men. I hope the new president and his staff will understand these kinds of challenges and be willing to work with them. ■

*Lisa Watts is a freelance writer and editor living in Boston who has worked for* Newport *magazine,* Northeastern University Alumni Magazine, Rhode Island Monthly, *and other publications.*



*Michael Dertouzos, PhD '64*
*Director, Laboratory for Computer Science*
*Leader of "Made in America" Productivity Commission*

## The world has changed, and business as usual at MIT won't cut it. We have to move from leadership in science and technology to leadership through science and technology.

It's no longer conceivable that a person leading the nation, or a lawyer or doctor, can be ignorant about science and technology. Conversely, it's inconceivable that we can graduate technologists who know only one narrow branch, who don't know about broader issues.

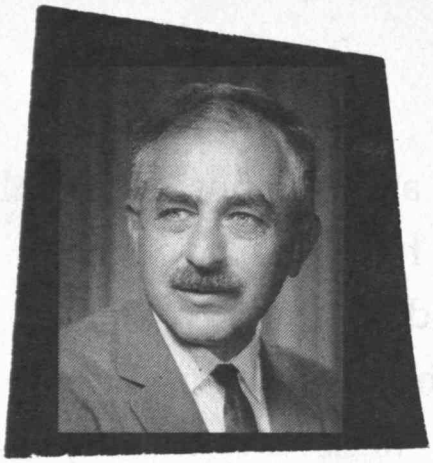
It's inevitable that an engineering degree will go to five years. In the early 1900s, lawyers and doctors went to school for three or four years, not seven or eight. So anyone who cries that five years is too much for engineers should look at those professions—leadership does not come without cost.

Perhaps we should think of what we have to offer in three branches of education. One is the familiar one of leadership in science and technology—training experts. If we lose that, we'll be dilettantes and not very good at anything, broad or narrow. Second is leadership through science and technology, with an emphasis on through. If our graduates are to lead in the corporate, government, and educational arenas, we ought to prepare them with more than knowledge of a narrow discipline. Third, we could educate people who aren't techies. I'd like to see us offer a technological alternative to a liberal arts education—for lawyers, managers, doctors, diplomats—people who are going to be in professions and who would enhance their leadership through a better understanding of science and technology. A kid could say, "I'm going to MIT for my tech-based liberal-arts education."

We can't do this casually by mixing narrow excellence with breadth and producing a lukewarm soup. I want a scalding, burning soup, with excellence in science and technology and in the broader, surrounding issues. I think we can have both—those who are experts, and those who are broader. Who knows, some day we may get rid of the artificial polarization among techies and humanists.

I see the same thing for research: leadership through science and technology. After World War II, the engineering profession began to move from practicality to abstraction. How many of us here at MIT are working on an innovative Third Boston Harbor Tunnel? Why aren't we working on a new car for the 21st century? Instead we focus on smaller, abstract problems. If this is a pendulum, it has swung too far away from reality. I don't want to reduce the engineering abstractions we have gained. Our challenge is to work on more practical problems, using and enhancing the abstract. We should get closer to industry, do more joint projects.

We need to spend more attention on Europe, too. We've neglected our European connections when it comes to our research. Yet we have many alumni there. That whole area is going to grow economically and technologically by leaps and bounds. And our students could benefit from study abroad, both in Europe and in Asia. We could and should think more internationally, even in terms of a bigger MIT presence in these two continents. ■



*Louis D. Smullin, SM'39*

*Professor emeritus*

*of electrical*

*engineering*

## MIT should take the lead in transforming a defense-driven technology to peace-time concerns—addressing everything from high-speed rail to energy and solid waste.

Much of our science and technology industry since World War II has been driven by the defense establishment. Not in any kind of sinister plot, but simply because the money comes from there, and so have many of the most difficult, challenging problems.

Now that it looks like the cold war is over, and that phase of the military is fading, we read about the Raytheons and General Dynamics having to lay off workers because of contracts being scaled back or cancelled. This is a difficult situation where simple conversion isn't going to work. You can't take McDonnell-Douglas' military operation and convert it to building refrigerators. Our country doesn't need a new refrigerator factory. We aren't starving for new consumer product capability.

But we do have in this country a growing class of problems in the civilian sector. Providing efficient, high-speed ground transportation is one example; finding alternative energy sources is another. At the low-tech end, what do we do with our urban waste? Are incinerators okay? These problems are beginning to choke us.

And in between the low-tech and high-tech problems is a whole range of concerns. If you believe in the greenhouse effect, what are we going to do about it? How can we heat our homes, cook our food, and drive our cars without burning carbon—which is what our world has depended on since Prometheus? It will take a massive effort to develop alternatives.

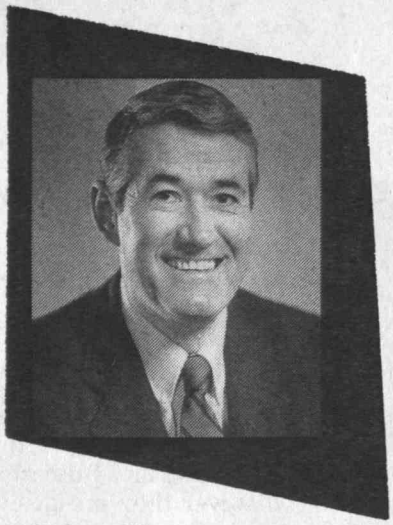
So there's a large range of technological problems in the civilian sector that needs addressing. This is a job for MIT, to take the lead in defining a broad menu of civilian-sector projects.

Making the adjustment to these projects will be difficult. President Vest must assume the responsibility, both internally and externally, for leading us into this new endeavour. Internally, making the switch is a slow process. If you've had defense contracts that have allowed you to hire staff, you can't say, two years into a project, 'I quit.' I call it our golden chains—we're all tied by our various successes, and they keep us from making overnight jumps into other fields.

On the other hand, we may not have so many of those golden chains in the near future. The same force that cancels those Raytheon contracts can cancel ours, giving us our own conversion problem.

The president needs to provide clear leadership about the desirability of working on civilian projects. An assistant professor has to know that if he or she goes to work on ways to recycle newspapers, for example, that work will be respected for the tenure decision. And Vest has to find the funds to support that professor's work. Because these research paths are still relatively untrodden, the active support and leadership of the MIT administration will be essential.

Finally, there's been a lot of discussion over the years about MIT trying to be an Ivy League school, more rounded. Many of us don't believe that's desirable or even possible. We have a reputation for excellence in a relatively limited domain—science, engineering, management, and economics. It's most important that we continue to be MIT, where that T means science and engineering. Society has supported us mainly because of our unique contributions in those fields. ■



*Robert Birgeneau*

*Chair and professor of physics*

## MIT should hire the most outstanding faculty in their fields, not those who fit into some niche that seems to suit the fashion of the time.

When I hear about the U.S. moving from a defense-based economy to an era of rebuilding economic competitiveness, and MIT needing to lead the way, I get worried. We have a very creative faculty, so as funding shifts from one arena to another I'm sure the faculty will adjust. But we can't hire people because they appear to be better for short-term economic leadership.

I think Derek Bok [outgoing Harvard president] put it quite nicely. He said he's made it his highest priority to attract and support the most outstanding faculty possible, because the quality of the faculty defines the institution. I'd like to see Vest do the same. With outstanding faculty we will automatically attract the best graduate students and undergraduates.

We're going to have to use more MIT resources to support junior faculty. We fall far short both in terms of offering good start-up packages for young faculty and in continuing to fund them until they can establish their reputations in research.

It's very important that members of the upper administration communicate that they prize the work faculty are trying to do and that they will support it in whatever way they can. In addition, we must make sure that we reward good teachers monetarily—our premier salaries shouldn't go just to the best researchers.

We need to modify how undergraduate engineers are educated. I'd like to see a considerable broadening of our undergraduate programs. The proposed five-year program for a professional engineering degree seems quite sensible to me. The extra year should enable us to educate engineers who also will have the backgrounds to make them effective corporate leaders.

In the humanities, our faculty all too often view themselves as second-class citizens here. That's reflected most directly in their salaries. The new administration must ensure that the humanities prosper at MIT. We shouldn't try to mimic Ivy League schools, but we could support at least a limited number of PhD programs in the humanities. Once we decide to do this, we have to make sure these doctoral programs are of the same caliber as those in other departments.

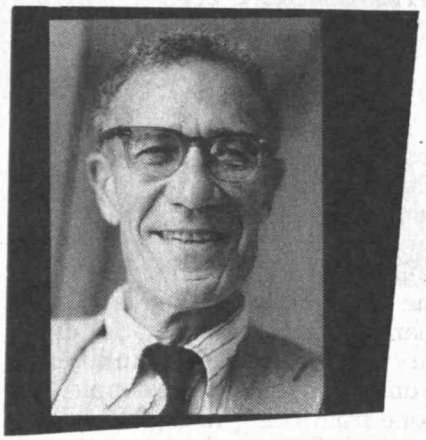
One continuing problem for department heads is that our salaries are simply too low. The current administration has taken a conservative view of our financial picture. At Yale, salaries for scientists and engineers are going up at the rate of 9 to 10 percent a year. Ours are increasing at a rate of about 5 percent. This will have catastrophic consequences for MIT if the disparity continues for many years.

One of the great achievements of the last administration is the remarkable cultural and racial diversity on campus. The number of women students, for example, has gone from being negligible to one-third of all students. I can cite as a specific example my middle daughter, who is in her sophomore year here. Ten years ago she wouldn't have even considered MIT. Similar progress is being made for underrepresented minorities, who now constitute about 15 percent of the student body.

I'm much happier with the freshman class now than when I came here 15 years ago. The students are more well-rounded, more articulate, and in the long run more likely to play a leadership role in society as a whole.

Still, many undergraduates feel alienated from the Institute because it's too large and impersonal. I'd like to see us move in the direction of a college system like that at Yale, where diverse groups of students live and eat together as a group after freshman year. Every faculty member belongs to one of the colleges, where they eat some of their meals and attend seminars. This provides for many faculty–student interactions outside the classroom—something which happens all too rarely here at MIT.

I'm not sure how we can financially manage the creation of a college system. One avenue might be that as funds are raised for either undergraduate or graduate housing, we simply begin converting undergraduate dormitories to graduate student housing. We would then use all of the available funds to begin construction, one at a time, of undergraduate colleges to house, say, 400 students. ■



*Robert Solow*

*Institute professor of economics, chair of the faculty presidential search committee*

## The administration's biggest internal priority is making decisions to update engineering education.

We talked to many members of the engineering faculty during the search for a new president. They were intensely aware that the nature of professional engineering is evolving rapidly and that the content of engineering education has to change with it. MIT is the natural leader in this process, and the engineering faculty is already well into it.

Our new president, as an engineer himself and as the past chief academic officer of a great university, will be able to contribute to these changes in several ways. He will have ideas of his own about the future of engineering education. His appointments can play a big role in promoting interdepartmental and interschool discussions. Organizational changes may be needed and, no doubt, some money. If only straightforward curricular changes were called for, the president could just lend a sympathetic ear. But these changes will require cooperation among people and groups who are accustomed to going their own way.

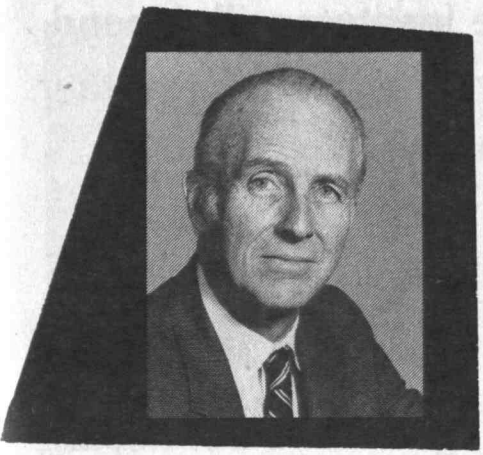
One of the things I learned during the search is that the needed restructuring of engineering education goes beyond the school of engineering. The systems that engineers now have to understand and design are very large and complex. These questions will entail new relationships between the schools of engineering and science, in both teaching and research. Engineers also will have to know how to think about the economic and human aspects of whatever they are designing. Modern complex systems involve human agents and social structures as well as physical components.

One other issue in undergraduate education is what we all recognize as the rat race. "Tech is hell" is a nice slogan until it becomes true; then you have to worry about what we're doing. We pile a lot of work on students. Since they are very bright and competitive, they do the work. We impose the rat race on them, and they accept it. The question is: how do you get yourself off that without losing educational value?

We also do it to ourselves. Many of my colleagues work long days, bring work home at night, and they don't see anything in their work that doesn't need to be done. They dislike all the paperwork involved in getting research funding—and now with money getting tighter, that burden increases.

I've detected more explicit feeling that the rat race has gotten out of hand. It may have been exactly the same 20 years ago, but I think not. I was struck by the large number of people we talked with during the search who had this problem on their minds.

The new president and provost will want to get into this issue and discuss it with students and faculty. I don't have a solution. ■



*Joseph Gavin, '41*
*Retired president of*
*Grumman Corp.,*
*member of MIT's*
*Corporation Committee*
*on the Presidency*

## We need less emphasis on cookbook science and engineering and more emphasis on general understanding.

Every so many years we have to go through an examination of the curriculum to keep it from getting in a rut. It's a difficult process but healthy. I give great credit to those in the middle of things trying to see what can be done.

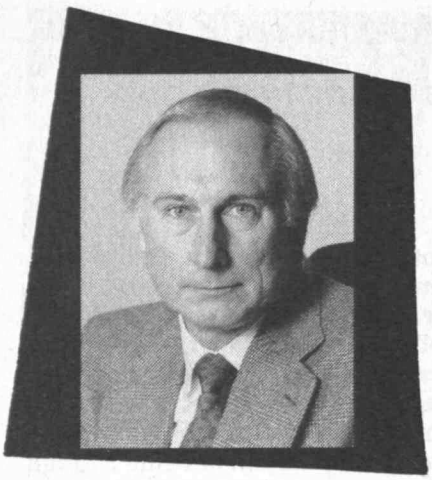
In engineering, the whole issue is that if we're going to graduate real professionals, four years may not be enough. These fields have grown tremendously, and the expansion of knowledge goes on and on. I don't think aeronautics faculty worry about how to build biplanes anymore, but in my time they did. In materials, we had none of the composites, very few plastics, and nylon was just being introduced. In electrical engineering, the focus used to be how to generate power and build a motor. Computers hadn't even put in an appearance.

Professional ethics is an increasing concern as well. Instead of teaching ethics as a separate subject, it should be woven into subjects. I had a professor of aeronautics who made it quite clear what our standards should be: "You are responsible for this aircraft. You better make it strong enough."

Quite a number of faculty will probably be retiring or doing less in the near future. This represents both an opportunity and a challenge. We can hire bright young people, but we have to do a good job of recruiting them. That's not always easy. Some institutions pay better, and the housing market in this area is very discouraging. MIT has the reputation of being a tough, no-nonsense place, so other places may look more attractive. New faculty members will come here, despite these discouraging factors, if they believe that the department they're considering is the best.

Another issue is the access foreign nationals have to the technology generated on campus, where federal grants provide much of the research support. MIT President Paul Gray had to testify before Congress on this issue not long ago. The fact that this is a concern suggests that U.S. industry isn't as diligent as foreign industry in pursuing the same information.

If you look at the percentage of graduate students who are non-citizens, it's clear that we're running an international institution. The reason foreign students are here is that we're the best. People forget that before the war, the thing was to go to Europe to study science and technology. The U.S. wasn't the magnet it is now. It's a great vote of confidence in MIT that so many foreign students come here. ■



*Raymond S. Stata, '57*
*Chairman and CEO*
*of Analog Devices,*
*member of MIT*
*Corporation*
*Committee on the*
*Presidency*

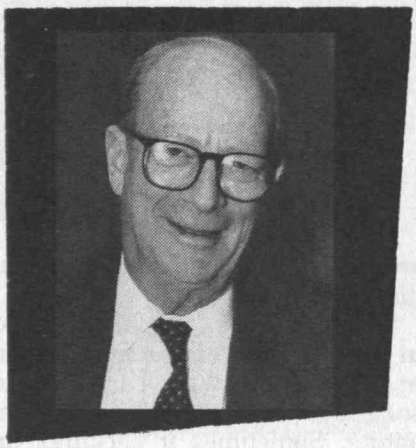
**The performance of the Institute will depend more on how effectively its parts work together than how they perform separately. The president's biggest job is selecting a top management team that can help achieve this cohesiveness.**

The challenge of the 1990s, in industry as well as higher education, is how to manage complex organizations to more effectively achieve their missions. How MIT is managed should be rethought. Perhaps the Institute should become more centralized in defining such strategies as which public policy issues to pursue and how to engender interdisciplinary cooperation, but less centralized in administration of departmental compensation and services.

MIT must sharpen its focus on actively and visibly addressing society's needs in areas where it can make unique and valuable contributions. *Made in America* is an outstanding example of what MIT can contribute. The Institute needs to do more of this by helping America address such challenges as international competitiveness, education reform, management innovation, hazardous waste, alternative energy sources, and environmental concerns. While the president can use his position to preach and urge the importance of science and technology, his case is more compelling when supported by actual examples of MIT's contributions—examples of projects that policymakers and the public can understand.

Performing the research and solving the problems is only half the battle. A lot of energy must go into communicating the research results. There are many areas of research such as automotive innovations and waste disposal where an annual briefing in Washington for congressional delegates, policymakers, and the press would be useful.

There comes a time to close the debate on the educational mission of MIT. I'm on the side of retaining the historical focus of providing first-rate science and engineering education and not trying to compete with Harvard and Yale for students with different orientations. That is not to say that we should not go further in broadening the minds of the students we graduate, but that is different from broadening admissions criteria to accept more students with only a secondary interest in the core educational mission of the Institute. ■



*Carl M. Mueller, '41*
*Retired vice-chairman of Banker's Trust, chairman of MIT's Corporation Committee on the Presidency*

## Vest's principle role will be building a consensus on the issues. His leadership has to be subtle; he can't ordain.

The most obvious and immediate task for Vest will be mastering the budget. I've seen this effort in my own years on the executive committee of the MIT Corporation. If you balance the budget one year, you're in a deficit the next because expenses always rise faster than income. Vest is going to have to find ways to live with much lower levels of government support for student aid and research. At the same time, everyone is clamoring for more resources.

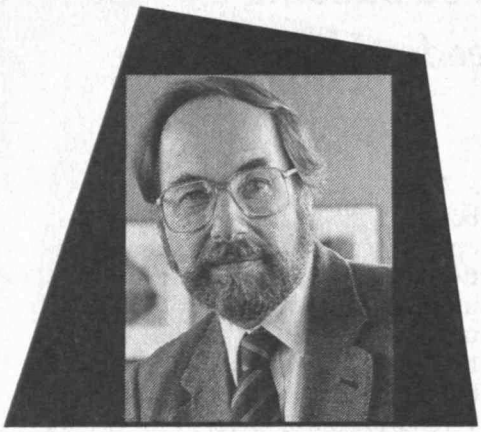
Second, he has a major problem in better articulating the work of scientists and engineers. Everyone is inclined right now to pillory science and technology; but the solutions to our most pressing problems—the greenhouse effect, AIDS, pollution, and others—aren't less technology, they're more. Someone has to redress this attitude, all this beating up on scientists. The responsibility doesn't have to sit solely on the MIT president, but he can play a role.

Like most universities, the Institute doesn't function like a business. The president doesn't have the management privileges one has in an industrial organization, where one can say, 'If you don't like it, leave.' That isn't done in the academic world. Everyone we talked to at the University of Michigan, by the way, told us that Vest has a superb record of consensus-building there.

The Whitehead Institute, with its world-wide reputation as one of the best molecular biology institutions, epitomizes the iterative process between the administration and faculty [required] for most of the great undertakings at MIT. That institution wasn't devised and put in place by the president alone. Creating the Whitehead in its present form took at least a year's negotiation among the president, the provost, the faculty, the corporation, and Mr. Whitehead and all his lawyers. At one point, the president had to veto [some of] the plans. But in general the president's job is to promote a consensus.

I've been through three presidential searches now. People always think you're looking for someone with a certain bent that he will enforce when he takes office, but that just isn't the case. People think the president is going to be the one to lead them up over the hill, like in the military, and it's not like that either. The president has to be a leader, but in much more of a consensus-building way.

People also think you can figure out what the major issues will be for the next administration. When we started this last search, I asked each of the living former MIT presidents what they thought the biggest issues would be before they took office, and then what the issues really were. They all smiled and said there was no relation between the two. None of us is smart enough to know what the crises will be two years from now. ■



*David Baltimore, '61*

*President,*

*Rockefeller University;*

*former director,*

*Whitehead Institute,*

*and MIT professor*

*of biology*

## Vest has to find ways to reach and to convince a skeptical public of the worth of science and technology.

Everyone will tell President Vest that his biggest job is fundraising. But to me, the most important role of a university president is to be an intelligent spokesman for the mission of the school. This is a difficult job at most universities because they're so diverse, but MIT's mission and its position are so unique that Vest has the best opportunity. MIT has become a kind of pop symbol for science and technology.

Vest needs to focus on communicating to the public the role of science and technology—in a world that is dependent on these things and yet incredibly critical of them. He should work to bring a measure of rationality to the public debate on issues such as pollution and environmental degradation. The debates at the national level on these things aren't focused on the scientific issues.

MIT should be a more accessible place for members of the media. If we take seriously the role of educating the public about science, then the only route to reach people who are out of school is through the media.

The Institute should take the lead in helping reporters get information or television footage. I tried to do some of that at the Whitehead Institute. Sometimes it backfires on you, when the interpretation of research results changes because of new information. But that is part of the scientific process.

For faculty, the issues of building a family while handling the enormous pressures of the profession—as well as typically receiving not very generous salaries—are difficult. I don't see how universities can compete with industries in salaries. But maybe we should find ways to make professors' jobs more attractive without focusing on salaries—offering help with housing, childrearing, and research expenses are some examples.

Having walked out of a lab and into a president's office this past summer, I quickly gained a sense of how isolating this job can be. It's important that Vest save some time for the classroom or the lab, to keep some perspective. ■



*Margaret MacVicar, '65*

*Dean for*

*Undergraduate*

*Education*

## The Institute is in a period of transition, emerging from its adolescence and wanting to take the next step. No one person can tell us what direction to take.

I see a great number of parallels between where our institution is these days—where it is going, our concerns about it—and the way the nation feels about itself right now. In part, that's because the nature of the Institute is at the heart of what drives the nation: both are technology-based. The ethos of engineering, which has defined the Institute well beyond the School of Engineering, is an ethos that wants to put knowledge to work, to serve the country.

I see three things going on: the country is confused about where it's going, what it wants to be; engineering as a profession, as an ethos, is looking at itself with some discontent and wanting to mature; and the Institute is going through a kind of adolescence, seeking to become more like an adult.

There is a little bit of the chicken and egg problem here as we all work through this. The changes within the School of Engineering are just talk now, just steam pressure building. But that school is such a major underpinning of the Institute that without it's changing, it is difficult for the Institute to change. And without the Institute's changing, it will be difficult for the nation's industry and management of technology to change.

I'm not talking about curriculum. Our curriculum simply follows from what we believe in as an institution, what we see as the whole academic experience. Curriculum is a metaphor around which we are arguing about what kind of Institute we are and what we believe in. The curriculum in a sense is a vehicle for self-examination.

This is not the kind of situation where one person—the president of the Institute, for example—just pronounces the answer and says, 'Let's do it.' Human beings are always looking for that Horatio Alger kind of direction—we wanted it in 1985 when John Deutch came on as provost, we wanted it in 1980 when Paul Gray started, and nationally people are looking to George Bush in the same way these days.

My simplest advice to Charles Vest would be: refuse to be bound by everyone else's expectations. Making a transition like this requires every individual to take responsibility. Over the past four or five years we've seen an increasing awareness across all parts of the Institute that change is needed. We have a critical mass now aware of what the questions are. The situation calls for the leadership of the new president and new provost to be more like that of a symphony conductor as opposed to a general leading the charge.

Vest has to listen to what people are saying, then see what they're doing. He can't get too disappointed if those two things don't seem to be consistent. We're moving forward, but it's not a tidy progression. The timing won't be a single moment; it will be smeared out over four or five years or longer. ■


MOUSE SYSTEMS

BY STEVE NADIS

*A pilgrimage to the surplus bins at Eli Heffron & Sons is a must for world-famous scientists and freshmen hackers alike.*

# The Surplus Shrine

Cambridge writer Timothy McCall wanted to boost the performance of his word processor by adding extra memory. He searched all over town for the requisite components. Finally his friend Neal Burnham, '77, suggested he try Eli Heffron & Sons, an electronics surplus store across the street from McCall's Inman Square apartment. Sure enough, McCall found the memory board and memory chips he needed.




Burnham learned of Eli's back in 1973, when he was an MIT freshman. Some electrical engineering upperclassmen dragged him there, telling him, "A physics major ought to know about this place. It's time you lived a little, saw what the real world is all about."

Burnham liked what he saw, and he quickly became an Eli's enthusiast. The thrill is in hitting pay dirt—such as a slightly defective Advent tape deck worth more than $1,000 that he picked up for $50 as an undergrad.

"I still go there every couple of months to see what's lying around," said Burnham. "You never know what you'll find."

Eli Heffron opened his store at 139 Hampshire Street in 1948, and electronics buffs have flocked there ever since. Among the notable Eli's regulars are artificial intelligence don Marvin Minsky and Harvard physicist Paul Horowitz (author of the now-standard text on electronics). "You go to India to visit the Taj Mahal, and you go to Cambridge to visit Eli's," said Horowitz.

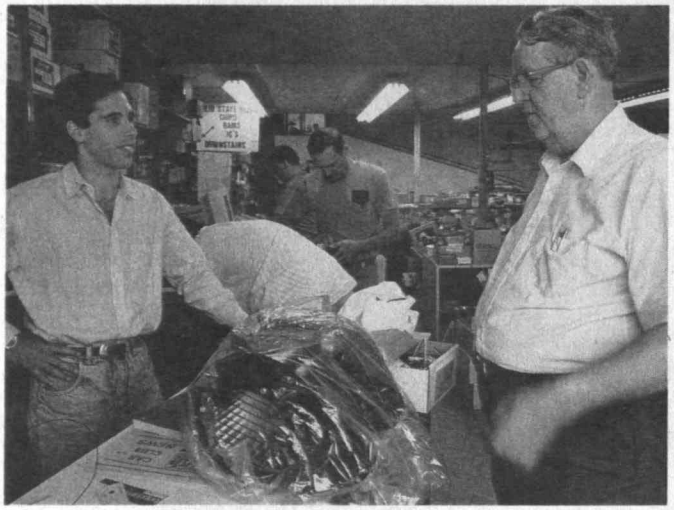
Originally the shop sold military surplus and test equipment such as radars and oscilloscopes. It still stocks some of those items, but it specializes more in new and used computers and assorted parts.

"In the old days, things were sold by the pound," said Neal Heffron, a grandson of Eli and the company's vice-president. "A guy once came up to the counter carrying a telephone and asked how much. My grandfather shrugged and said five dollars. A while later, someone asked where the pay phone was. That's when Eli realized he'd just sold it for five bucks."

Since then the phones have been bolted more securely, but prices remain kind of loose. Capacitors, for example, are sold by the handful for about two dollars. You can buy 20 or so resistors for a buck. Other items are sold by the bagful. Piles of small items fill tables in the center of the store. Larger equipment is stored on racks off to the side and upstairs.

"We have generations of equipment," said the third-generation Heffron. "Things that are 10 years

PHOTOS: L. BARRY HETHERINGTON



*Neal Heffron (left) of Eli Heffron & Sons discusses surplus electronics parts with a customer.*

old are mixed in with things that are a few months old. What's obsolete in one person's mind is a treasure to someone else." Used laser tubes taken from the inside of grocery-store price scanners, for example, are particularly popular among MIT types. A 100K potentiometer goes for 25 cents, a Sun minicomputer for $10,000.

Parts scattered in bins include AC filters, belts, optics from laser printers, integrated circuits, transformers, surface-mount breadboards (also called "surfboards"), and VLSI chip holders. Larger equipment on the racks includes disk drives, plotters, muffin fans, cathode ray tubes, oscilloscopes, and an old radar system.

"I'd love to sell that by the pound, because it weighs so much," Heffron said of the radar. Touring the inventory, he continued. "These are power supplies. These are digital printers. I have no idea what that is"—he pointed to a gray box with knobs and dials. "I might find out when someone [who's been waiting years to put his hands on this sort of thing] comes in and buys it. Or maybe it will disappear and I'll never find out."

Heffron admitted that some of the regular customers know more about what's in the store than he does—some customers even get mistaken for employees. The Heffrons, from Eli to son Bennett to his son Neal, have been businessmen, not engineers. Through ads in trade magazines, direct-mail brochures to large manufacturers, and word-of-mouth reputation, they've gathered their inventory of obsolete parts, overstocks, and cast-off computer systems from universities.

Most of the customers are computer hackers and electrical and mechanical engineers; roughly half of them come from MIT. Members of the Tech Model Railroad Club, for example, have frequented Eli's for years.

"It's a social event," said Heffron. "People meet here in the morning with coffee, look around, talk, see which gizmo they can hook up to which motor. Then they go back to their labs and put them together."

David Silver—the precocious tinkerer whose exploits were chronicled in Steven Levy's book *Hackers*—started hanging around Eli's when he was six. A few years later, he bought an old radar dish there which he hooked up to a microphone, enabling him to eavesdrop on conversations and bird songs thousands of feet away.

Steve Burns, '62, technical director of MIT's Biomedical Engineering Center, has been visiting Eli's since the day he arrived at MIT as a freshman in 1958. He was supposed to attend an introductory lecture by the dean that day. He never went because "the upperclassmen told me I could learn a lot more from an afternoon at Eli's. The thought of a mountain of electronic equipment—the Mt. Everest, in fact—was so tempting that off I went." After his freshman year, Burns' father drove him back to Michigan hauling a trailer filled with electronic equipment. Burns' work designing and building instruments for his lab still brings him to Eli's in search of parts.

Steve Finberg, an electrical engineer at Draper Lab and a ham radio enthusiast, comes to Eli's practically every Saturday afternoon, which is the most "happening" time of the week. In fact, he's missed so few Saturdays at the shop in the past 10 years that he can name them—the one weekend last August when he went away with his girlfriend, for instance. Finberg was on the team that built the *Daedalus* aircraft, partly out of components—semiconductor chips, read-out meters, stepper motors—purchased at Eli's.

Burns counts among his favorite Eli's purchases the heat re-entry cone of a decoy missile he picked up years ago. He has yet to put it to any strategic uses. "I think it's still sitting in the garage," he said. "It's too heavy to move."

He recalled one guy who really found treasure at Eli's. He bought an old computer and spent a year salvaging gold—literally—from its insides. "He made a reasonable income for his effort, because gold was selling at $800 an ounce," Burns said.

Finberg agreed that Eli's offers booty for those who are persistent. "They have far more exotic stuff than a Radio Shack, but on any given day, who knows what will be there? I've found tons of real treasures, and bits and pieces of things I thought were real treasures that didn't work out," he said.

He knows that the true Eli's gems come when, as the Cambridge writer searching for computer memory can attest, "you need something, and don't know where in the world you're gonna find it, and it turns up here." □

*Steve Nadis is a* Technology Review *contributing writer.*

# CLASS NOTES



*Marion Rice Hart, '13*
*navigator, aviator,*
*author*

## 13

**Marion Rice Hart,** the first woman to graduate in chemical engineering from MIT, died last July 2 in Berkeley, Calif., at age 98. Among her many talents, she was a navigator, who sailed a ketch around the world; an aviator, who learned to fly at 54 and made seven solo flights across the Atlantic (the last at age 83); and author of magazine articles, two books on navigation, and one book on flying. She was also a ham radio operator and served in the Army Signal Corps throughout World War II. Hart received the Harmon International Trophy from Vice-president Walter Mondale in 1976 for her feats operating a "small aircraft on a global scale." She wanted to see the world (and not just sit around the house), she told a reporter in 1972 when she was 81 years old. Her niece, Dorothy Rice, says, "The feminist movement didn't mean much to her because she did whatever she wanted before feminism." Ms. Rice also recalls that Hart was no slave to fashion—she had only three dresses, "one she was wearing, one in the wash, and one just in case." (See *Technology Review,* April 1988, p. MIT 19.)—*ed.*

## 16

Please send news for this column to: **Bob O'Brien,** acting secretary, 25 Keith Rd., Pocasset, MA 02559

## 17

Please send news for this column to: **Don Severance,** acting secretary, 39 Hampshire Rd., Wellesley, MA 02181

## 18

Faithful **Herb Larner** sent me a copy of his letter to the *Boston Herald* supporting John Silber's position on abortion.

I record with sadness the passing of **Herb Polleys,** of New Haven, Conn., last May 21 at age 95. He was a direct descendant of Roger Williams, founder of the state of Rhode Island and a grandson of clipper ship Captain William Zebedee. During World War II, Herb left MIT to work on aircraft development. He also worked on bullet-proof fuel tanks for aircraft and served on the Connecticut Commission on Aid to Small War Industries. He received more than 22 patents, including foreign patents, on rubber and rubber-product processing. In addition to memberships in professional societies and civic organizations, Herb was past president of the New Haven MIT Club. Besides his wife, he leaves a son, 3 grandchildren, and 5 great-grandchildren.

In the same month, **Ted Pierson** died in Munroe Township, New Jersey. He retired in 1961 as vice-president of production for the Homasote Co. after 25 years of employment. Besides his wife, he leaves a son, 2 daughters, 9 grandchildren, and 15 great-grandchildren.

Also, we have been advised of the death of Henry C. Stephens, of Honolulu, Hawaii, on August 9, 1988. No further details were available.—**Max Seltzer,** secretary, 865 Central Ave., Needham, MA 02192

## 19

**Alan B. McIntosh,** a well-known member of our class died last June 17, 1990, at age 93. He was a frequent attendee with his wife and guests at our class reunions. He was a retired electrical engineer for S.A. Woods Machine Co. of South Boston and for many years was active in the government of nearby Needham Township. He was a veteran of World War I, a member of the Neholder Masonic Lodge, and the Congregational Church of Needham. Also, he was a member of Eastminster Presbytarian Church in York, Pa., the Exchange Club of York, the York County Historical Society, and was a York Hospital Volunteer. He is survived by two sons, Alan C. McIntosh of Westford and David C. McIntosh of York, Pa., seven grandchildren, and seven great-grandchildren. Like so many of our classmates, Alan was an active member of the society in which he lived, and we shall miss him.

Barbara and **Don Way** sent us a card from Newfound Lake, N. H., where another member of our class, the late **E.G. Paterson,** Izzie as he was lovingly called, had his summer home. The Ways were driven up there by their son, Curtis.

For me, I am able to cut two acres of lawn every five days and, being now able to read, I am catching up on a four-year back issue pile of *Technology Review.* Very good reading, too. Best to you all.—**W.O. Langille,** secretary, P.O. Box 144, Gladstone, NJ 07934

## 21

New England College presented an honorary degree to **Francis O. Holmes** during the commencement exercises last May 13. He had a long career in botony and wrote two books and 180 articles on plant diseases and is credited with curing several plant viruses. Besides his degree at MIT, he earned a doctorate in science from Johns Hopkins in 1925.

A soberingly long list of deaths was received this month: **Edmund E. Brady,** Washington, D.C., February 15, 1990; **Henry C. Nelson,** Augusta, Maine, January 23, 1990; **Eugene A. Hardin,** Tucson, Ariz., April 1, 1990; **Thomas H. Derby,** Andover, Mass., May 6, 1990; Col. **Robert A. Hill,** Scottsdale, Ariz., April 2, 1990; **Harry Butters,**

Weymouth, Mass., September 1, 1989.

Thomas Derby worked on water problems for the town of Methuen. He retired in 1970 as head of its Engineering and Mechanical Drawing Department.

Condolences are extended to the families of these classmates.—**Sumner Hayward,** secretary, Wellspring House E64, Wash. Ave. Ext., Albany, NY 12203; **Samuel E. Lunden,** assistant secretary, 6205 Via Colinita, Rancho Palos Verdes, CA 90274

# 22

These notes are being written in Maine in August. Ruth and I are on vacation at Goose Rocks Beach away from the *Techniques* and other class records that help the memory. With about 100 remaining '22ers, the odds are that something good or bad must be happening between issues to a few of us. Without giving names. I can report on the down side, a broken arm (healing okay) and a properly repaired inguinal hernia. On the good side, no knowledge of strokes, heart attacks, or Alzheimers.

Deaths to report. **Edwin J. Purcell** died on September 27, 1989, at age 88. He was professor emeritus at the University of Arizona from which he received a BA in 1929. There followed an MA from the University of Colorado in 1931 and a PhD from Cornell in 1932. He is survived by his wife, Bernice. . . . **Roger Carl Bauman** died in June 1988 in Fairhope, Ala. He is survived by his wife, Helen. . . . Eleanor Dingee, widow of **Alexander L. Dingee,** of Watertown, Mass., died December 10, 1989. She is survived by her daughter, Barbara. . . **Joseph J. Forrester** of Tonawanda, N.Y., died September 28, 1982. . . . **Charles W. Staples** of Frederick, Md., died June 27, 1989, shortly after the death of Mrs. Staples on February 21, 1989. . . .Louise Dishman Ellicott, widow of our classmate **Theodore H. Ellicott,** died January 11, 1990, in Manchester, Mass. She is survived by a son and two daughters.—**Yardley Chittick,** secretary, Rt. 1, Box 390, Ossipee, NH 03864

# 23

First and foremost, we find that we have a new president for our venerable institution. MIT has been fortunate in the caliber of our presidents (two from our class), indicating care in their selection. It would appear again that our good fortune follows us. A picture of President-Elect Charles M. Vest and his fine family appears on page MIT 2 of the *Review,* August/September 1990. Bless them in their new undertaking.

I apologize for the lack of class notes in the last issue. Your secretary had a series of upsets, including more or less minor surgery, and a bout with the sciatic nerve that lasted several weeks and was quite painful. For a while, breakfast cereal consisted of a bowl of Tylenol. Unfortunately, I received no news about our attendance at Technology Day. Thinking that Bondie might have attended, I called him, but he also was unable to be there.

**Harry Kalker** wrote our class president, **Royal Sterling,** some time ago. Harry said he had been enjoying working for the last four years with the MIT Center for International Studies on a program with the State Department that he hoped would some day develop into a diplomatic academy for training people who would like to join the foreign service. . . . A short note from **Dick Frazier**'s wife, Muriel, stated that he was doing well and that she was writing a book in her spare time, the third book, having finished two others. Congratulations.

A follow-up on the passing of **Al Pyle** came from his daughter, Cynthia. He died of a severe case of pneumonia. A copy of a memorial service held in the First Unitarian Church, Wilmington, Del., May 5, 1990, was enclosed. . . . Also, a note from Charlie Speigel, regarding more on **Philip Schwartz,** Course II. He enclosed a fall 1989 newsletter of the MIT Club of Southern California containing a letter from Phil's daughter. Phil was chairman of the placement committee and vice-president of area representatives. Both letters emphasized the zeal Phil had in steering candidates to MIT.

Unfortunately, I must report the deaths of several of our classmates. **Frank Miller II** of Middlebury, Conn., died March 28, 1990. He was employed for many years until his retirement as an investment counselor with Cooley and Co. He and his wife had a daughter, a son, ten grandchildren, and eight great-grandchildren.

**Einar A. Hanson** died March 10, 1990. Before his retirement, he was president of Hanson-Whitney Machine Tool Co., Hartford, Conn. He and his wife, Katherine, had two children, six grandchildren, and two great-grandchildren. He was a member of St. Andrew's Club and Little Club, both of Delray Beach, Fla., and the Hartford Club and Hartford Golf Club of Hartford, Conn.

Word has come of the passing of Professor **Kenneth G. Crabtree** of Ellsworth, Maine. After graduation, Kenneth worked in the Bell Telephone Laboratories for three years, then joined the faculty of the University of Maine where he remained until his retirement as a professor of electrical engineering. He and his wife, Vyra, had four children and 14 grandchildren. His recreations included fishing, lobstering, and bowling.

**Harland C. Forbes,** a public utilities executive, died May 15, 1990, in Sarasota, Fla. After graduation, he joined the Consolidated Edison Co. of New York, and rose to the position of chairman of the board. Harland was a trustee of Consolidated Edison and of New York Bank and Savings. He was also a director of Erie Lackawanna Railroad. His membership included several prestigious clubs in the New York and Sarasota areas. He and his wife, Elizabeth, had two sons, six grandchildren, and three great-grandchildren.

**Robert B. Prinze** of Dayton, Ohio, died in September 1988. Information is brief. After MIT, he apparently went on to do general engineering in the Tech Integration Division, WSD, Wright-Patterson Air Force Base, Ohio.

**Herman F. Stafford,** an Army officer died October 7, 1988. He received a BS in mechanical engineering at Worcester Polytechnic Institute, taking post ordinance studies at MIT and at the Army Industrial College, Washington, D.C. He was a member of clubs at MIT and president of his fraternity, Theta Chi. Married to Odette Riviere in Bordeaux, France, they had two children and five grandchildren. During World War I, he served with combat artillary AEF in France and during World War II served in the office of the Chief of Ordnance, Washington, D.C. He was promoted to brigadier general in 1943. Following World War II, he became president of Ohio Rubber Co., then vice-president and director of Eagle Picher Co., and later director and officer of several companies. He was also a member of several social clubs in New York, Cleveland, Ohio, and California, to mention a few. Golf and fishing were his main recreations.

**Dorothy Weeks,** a physicist, educator, and researcher, died June 4, 1990. After retiring from Wilson College, a women's college in Chambersburg, Pa., after 26 years as a professor and head of the Physics Department. Weeks joined the Ordinance Materials Research Office of the Watertown Arsenal as coordinator of a project that developed radiological shielding materials for use against nuclear weapons. She left the arsenal in 1964 to become a spectroscopist, studying solar satellites at Harvard Observatory. She retired in 1976. Meanwhile, she lectured in physics at the Newton College of the Sacred Heart from 1966 to 1971. She was the first woman to receive a doctorate in mathematics at MIT. Certainly a brilliant woman! . . . Condolences to the families of our classmates.—**Frederick O.A. Almquist,** secretary/treasurer, 63 Wells Farm Dr., Wethersfield, CT 06109

# 24

**Lynn P. Marsh** of Rockport, Mass., died November 25, 1987, at the Den Mar Nursing Home. He was born in Watch Hill, R.I. and attended schools in St. Augustine, Fla. He received a degree in aeronautical engineering from MIT and was a member of Sigma Alpha Epsilon. Before retiring in 1962, he was an executive state agent for the Home Insurance Company. He was past commodor of the Medford Boat Club, a member of the Sandy Bay Yacht Club, and past president of the Bay State Club, an insurance organization. He is survived by his wife Helen Abercrombie Marsh, a daughter, and six grandchildren.

**Christopher Michael Conway** of Pineville, La., died April 21. He was born in Medford, Mass. He was a member of Sacred Heart of Jesus Church, where he was a trustee, a lay lector, past president of the Holy Name Society, and Bishop's representative on the Parish Council. He was former secretary-treasurer of the board of the Alexander Kiwanis Club and vice-president of the Alexander SERRA Club. He was employed by the Bell Systems for 45 years. Survivors include his wife, Mary Ball Conway, a son, a daughter, two brothers, three sisters, and four grandchildren.

**Samuel Seltzer** of St. Louis, Mo., passed away in April 1986. He was president of Seltzer Engine Co. in St. Louis. . . . **Julius Lynch Piland** of San Antonio, Tex., died August 27, 1989. He is survived by his wife, Maritta G. Piland. . . . **Andrew McPhail Gault** of China, Tex., passed away on August 19, 1989. We were told of no survivors. . . . **Ruth H. Westbrook** of Charlotte, N.C., died May 23. Prior to attending MIT in 1924, she earned a BA degree from Wellesley College in 1921. . . . Ernestine Dirksen, wife of **Peter C. Dirksen,** adds to her previous report of her husband's death on October 20, 1989, that he was vice-president and general manager of New Bedford Gas & Edison Light in New Bedford, Mass. . . . A note from Carol MacLennan, daughter of **Herbert C. Moore,** tells of her father's death on October 25, 1989.

Our sincere condolences to all the families.—Co-secretaries: **Katty Hereford,** Hacienda Carmel, No. 237, Box 5397, Carmel, CA 93921; Col. **I. Henry Stern,** 2840 S. Ocean, No. 514, Palm Beach, FL 33480

# 25

**Archer Nickerson** writes that he is enjoying retirement and family expansion. He has six great-grandchildren and by the time you read this column, it will be seven. . . . June 1990 was a month of celebrations for the Foster family. In early June our youngest grandson joined the ranks of MIT alumni/ae when he received a bachelor's degree in mechanical engineering. A few days after that event came the 1925 class 65th reunion. A few weeks later we were blessed with a second great-grandchild—this time a girl, the first in the Foster family in over 80 years.

It is with sadness that the passing of five classmates must be reported. **Harold V. Robichau** died June 30 in Beverly, Mass. He worked for many years as a structural engineer with the Boston firm of Stone and Webster. He is survived by his wife Florence, three sons, and a daughter. . . . **Phelps Meaker** of Mentor-on-the-Lake, Ohio, died February 5 at the Western Reserve Extended Care in Kirkland, Ohio. He was a retired member of Advanced Application Development in the Lighting Research Department at the General Electric Nela Park Plant. He was a member of the Illuminating Co. Engineering Society, where he was a fellow emeritus, and was also a former member of the American Crytogram Society. Phelps was instrumental in designing and engineering special lighting for the Alamo, Edison's birthplace, and the General Electric exhibit at the 1964 World's Fair in New York. He led tree walks and gave lectures through the Cleveland Museum of Natural

History, and wrote articles and gave lectures on lighting. He served in the Army during World War II, where he developed proximity fuse shells and received a commendation from the U.S. Office of Scientific Research and Development. He retired from GE in 1966 after 41 years. Survivors are his daughters, Virginia P. Walsh of Mentor-on-the-Lake, and Ramona Khuhro of Baldwin, Mo., and two grandchildren.

**Wendell F. Burbank** died May 11 at the Medical Center of Central Massachusetts in Worcester. He owned and operated Burbank Associates, an advertising business in Wayne, Maine, for 15 years, retiring in 1968. He previously was general manager and sales manager of the former Worcester Buick Co., from 1945 to 1953. Before that, he worked in the former Noyes Buick Co. in Boston. Wendell was a member of First Baptist Church of Worcester, where he was chairman of the board of deacons. He was active for many years in parish finance and fundraising. He was also past president of the residents association at Colony Retirement Homes in Worcester. He is survived by his wife, Elizabeth H. (Burr), and two sons. . . . **Harold E. Davis** died March 27 in Green Valley, Ariz. . . . Belatedly news of the passing of **Charles L. Gaines, Jr.,** has reached the Alumni/ae Association. He died in Birmingham, Ala. March 14, 1988.—**F. Leroy "Doc" Foster,** secretary, 434 Old Comers Rd., P.O. Box 331, North Chatham, MA 02650

# 26

Please note my change of address at the end of these notes. Mary has been in and out of the hospital lately, so she wanted us to move to Eventide Home, an endowed retirement home established in 1926. At present, residents number 9 men and 42 women. We have two rooms. Mary was on the board about 35 years and was the first woman president. She was president when we got married in 1973. Our mates died in 1972.

**Edmond T. Morris, Jr.** passed on April 6, 1990, leaving a daughter, Sheila Morris Julian. He was president of Roanoke Valley Development Corp. in Roanoke, Va., where he lived. . . . **Charles E. McCulloch** passed on April 2, 1990. He lived in Hightstown, N.J., and until 1986 at Highland Beach, Fla. He and Helen had two sons and five grandchildren. He designed and constructed petroleum refineries. Until 1967, he was president of Foster Whelan International Corp., with worldwide plastic plants. He resided in Paris from 1959 to 1961 and in London from 1962 to 1965. Charles had a great loss, as did MIT and the class, when just before graduation his twin brother David had an accidental death. . . . **George A. Makaroff** of Astoria, N.Y., left us December 27, 1989. Never married, civil engineering, sound motion pictures, news of the day, playwright (all flops he says), National Guard.

**Stewart Perry** of Winthrop, Mass., died May 5, 1990. When he was 8, he heard on a friend's radio about the *Titantic*. He built his first radio that year—1912. He received his license on the first day the government issued the permits. He became known by his correspondents in 100 countries and was a sales engineer with the Worthington Corp. in Cambridge, a maker of industrial power generating equipment. He leaves his wife, Marguerite, two sons, and five grandchildren. . . . **George A. Pournaras** of Baldwin, N.Y., died in July 1987. He was an equipment engineer for Texaco. Sorry no other information is available. . . . **Orin Moe** of Pacific Palisades, Calif., died in 1989. He was the senior engineer scientist at Douglas Air Co., Inc.

**William H. Stell, Jr.** of Rochester, N.Y., passed on January 11, 1988. . . . **Joseph J. Casey** of Baytown, Tex., died May 14, 1990. He was a plant superintendent at Humble Oil and Refining Co. . . . Col. **Joseph D. Bates, Jr.** of Longmeadow, Mass., left us September 30, 1988. He was president and director of Reilly Brown and Tapply, Inc. of Boston. . . . **Thomas M. Hotchkiss** of Montrovia, Calif., died June 5, 1989. He was chief mechanical engineer of South California Edison Co. of Los Angeles. . . . Captain **John A. Sweeton** of Medford, N.J., died December 28, 1989, following two years of ill health says Muriel W. Sweeton.

I am sure many of these classmates had great careers but did not tell us about it in the sheet sent to them for our 60th reunion. Next June will mark 65 years since we graduated. **Bob Dawes,** our president, is planning our 65th. Make your plans now.—**Donald S. Cunningham,** secretary, 215 Adams St., Quincy, MA 02169, (617) 328-1840

# 27

**Sidney Badger, Jr.,** of Woodland Hills, Calif., remarried on April 25, 1987, but his new bride gave him up after a few months, due to her lack of appreciation for his abode in the Hills. He says they are still good friends, but not together. . . . **Robert de Luccia** and wife Barbara of Lake Oswego are well and enjoy their home on a hill overlooking the lake. Our hydro-electric power authority classmate regrets the abandonment of our nuclear plants; every year there is a vote on whether to close their successfully operating Trojan plant. . . . **Allison (Bud) Gillies** of Ranch Santa Fe, Calif., and wife Betty are in good health, except that Bud has difficulty hearing on the phone and wears a hearing aid. . . . **Theodore S. Bogardus** of Berea, Ohio, taught for 28 years full-time at Baldwin Wallace College in a pre-engineering physics program. He is a registered professional engineer in Ohio and Pennsylvania.

We offer our sympathy to the wives and families of these classmates: **Alan S. Beattie** died on November 17, 1988, at his son's home in Mt. Kisco, N.Y. In 1946 he was general manager of Oxygen Co. and later became industrial manager for the parent company, American Home Products in New York City. In 1955 Alan and his wife Louise moved to Fairlawn, N.J., where he was product engineer with Elinson Freeman Co. He retired to Killingworth, Conn., in 1966 and took up the hobby of collecting and exhibiting brass antiques. Alan and Louise subsequently moved to Westport, Conn. We regret the delay in reporting his death. . . . **Fin Dallas Sparre** of Wilmington, Del., died on March 20. He retired in 1971 from Du Pont after 43 years. He was 26 years with their legal department, as a senior member of the labels and labels registration section. He wrote a book about the labeling of hazardous chemicals. He was first a research chemist in the nitrocellulose lab, and then in the explosives department of their Wabash River Ordnance Works, Newport, Ind. He had to give up about all sports following a dislocated shoulder that never healed properly in 1981. He attended our 60th reunion. . . . **John J. Dunn, Jr.,** of Boise, Idaho, died on April 9 of cardiac arrest. Formerly a resident of Bangor and Sedgewick, Maine, he moved in 1940 to form and be president of J. J. Dunn, Co., Inc. He retired to Boise in 1979. . . . **Albert F. Schaad** of Bennington, Vt., died on April 27 after a long illness. He was employed by Union Carbide Corp. in New York for 34 years. . . . **Leon M. Ogilvie** died on June 24. The Alumni/ae Association and my files have no record of his life history. He majored in civil engineering.

By the time this is published, your secretary will have been remarried (to Phyllis Norton), and his address will be Delray Beach during the winter, for a new lease on life.—**Joseph C. Burley,** secretary, 1 Harbourside Dr., Delray Beach, FL 33483; **Lawrence B. Grew,** assistant secretary, 21 Yowago Ave., Branford, CT 06504

# 28

As you read these notes the holiday season will be close upon us. So we take this opportunity to wish all of you good health, pleasant days, and a very good start into the new year.

We were pleased to have a letter from **Paul Ruch.** Paul's wife Dot, we are sorry to relate, died in January 1989 after a four-year bout with cancer. Before that they lived comfortably at Leisure Village in Camarillo, Calif., for 15 years. Now Paul has moved to a retirement center in Santa Ana, Calif., where his housing needs are well met and where he is only ten minutes from his office in Tustin. Paul and his son are in the unique business of long-range weather forecasting. They have developed techniques that give them "dry day" forecast accuracies of better than 83 percent with a lead time of three months. No one else has ever had this level of success. Clients range from brides planning wedding events to farmers, truckers, shippers, builders, amusement park operators, and commodities speculators. The Ruch Weather Services caught the attention of the *Los Angeles Times* to the extent of two-page coverage on November 6, 1988.

From **George Palo,** our class agent, we have a cheerful and enthusiastic report on a very successful year of contributions. Once again we led all other classes by having 66 percent participation. Much credit and our hearty congratulations go to George for these rich fruits of his year-round effort. The destiny of the Institute as a continuing world leader in top quality education and research depends heavily on the loyalty and support of the alumni body. '28 has always done its part well. Each individual gift increases our percentage participation as well as our total class contribution. Let us keep up the good work!

With deep regret we must report the deaths of four classmates: **William Beard** died February 16, 1989. Bill graduated in Course XI (municipal and sanitary engineering), and his education continued with a master's degree from U.C.L.A. and a PhD from Columbia University. Bill was convinced early in life that an education strong in both technology and the social sciences would best equip him for a career in teaching and writing. He was an instructor at California Institute of Technology, assistant professor at University of Wisconsin, information and publication chief at T.V.A., and then a self-employed writer. His books and papers placed him in *Who's Who in America*. Our record shows that Bill was married to Melba Gorby in 1933 and that they had a son and a daughter. . . . **Samuel Roderick Weibel** died June 20, while hospitalized for a respiratory problem. This sad news was given to us in a thoughtful and gracious letter from wife Lucile. Following graduation in Course I (civil engineering), Sam continued with graduate studies in biochemistry and sanitary engineering at Rutgers University, New York University, and University of Cincinnati. His life work was almost wholly with Robert A. Taft Sanitary Engineering Center of U.S. Public Health Services in Cincinnati, Ohio, where he retired in 1967 as deputy chief of engineering research. Sam made it evident that he and Lou lived a happy life with many interests in common and wholesome activities to enjoy. They have been among the most loyal of '28ers and were indeed all packed for travel to Cambridge and Technology Day last June when Sam was taken ill. The Weibels were blessed with a son and a daughter. . . . **Paul Theodore Wilson** died at the home of his son, Paul, on December 6, 1984. This information came only recently to the Alumni/ae Office from Paul, Jr. Our classmate Paul graduated in Course IX (general science and engineering), but we have no report on his later activities. . . . **Wentworth Dearborn Taber** died suddenly on June 8, while hospitalized. Wentworth graduated in Course XV (business and engineering administration). His life-long career was with Simplex Wire and Cable Co., Cambridge, Mass., where his administrative skills were applied in production. Surviving him are wife Marian, son Robert and two granddaughters. . . . We extend our heartfelt sympathy to the families of these classmates.—**Walter J. Smith,** secretary, 37 Dix St., Winchester, MA 01890; **Ernest H. Knight,** assistant secretary, Box 98, Raymond, ME 04071

# 29

Sometime in April 1990, **Raymond Jones** of Fish Hoek, South Africa, who graduated in aeronautical engineering, sent a letter to the MIT Alumni/ae Association inquiring about our class. I sent him a welcoming letter and invited him to become an active member and to participate in our activities. He replied, "My main purpose in writing was to inquire about some of my friends and classmates: **Ira H. Abbott*, Laurence Waite, Nicholas Oresko, Emerson Conlon, John R. Clarke, Selwyn Towne*, Paul Baker, and Vidmar Stromquist***" (* for deceased). Raymond's address (for those who wish to get in touch) is: 10 Erica Ave., Fish Hoek, 7975 South Africa.

From **J. Wesley Walters** and his wife, Josephe, of St. Paul, Minn.: "Another thank you for remembering my birthday greetings every year. The years have been good to me, to my wife and family. In the past year, two more branches have been added to the family tree, and two male great-grandchildren were added, making it nine in all. This past June 27, we observed our 61st wedding anniversary. Best wishes to you and to all class members." . . . **Harry F. Dickinson** and wife, Ruby, of Rontonda West, Fla., write: "After choosing early retirement from Anaconda Wire and Cable in 1966, we lived for 12 years on St. Thomas Island in the Caribbean—a very scenic and enjoyable place until the authorities were not able to give us services due to increased population. We then chose Rontonda West, a model community started in 1973 on the West Coast located between Sarasota and Fort Myers. And now, once again, rapid growth is overtaking us. I used to play golf, but membership fees skyrocketed and the restrictions of a private club became too cumbersome. Ruby and I are fairly good contract bridge players. In 1979, I became an ACBL certified duplicate bridge director, and I started the Duplicate Club in Rontonda. We still play once or twice a week. We enjoy beach picnics and are interested in gardening and swimming. We also maintain an active correspondence with quite a list of friends, widely dispersed, from the continental U.S. to Hawaii and England. We enjoy entertaining friends at dinner parties locally. **John F. Joyce** and I were close friends, visiting each other regularly until his death two years ago." . . . **Milton Male** and wife, Maxine, send a note: "We had a wonderful time early this month attending the wedding of our granddaughter, which was our first. We are both feeling well and are looking forward to our next Caribbean cruise, which has become an annual event. Give our best regards to all our classmates." Milton and Maxine live near us in the winter. We see each other socially for cocktails and dinner.

**Lewis Hess** and wife, Mary Helen, of New Smyrna Beach, Fla., took an enjoyable Mediterranian Cruise on the *Royal Viking Sun* last spring. They have one child and four grandchildren, and their hobbies include travel and music. . . . **John H. Tomfohrde** of Needham, Mass., writes, "My wife, Naomi, died last January leaving me quite alone, as we have no children and no close relatives at all. However, I am quite fortunate to be living in a retirement community, a life care facility where I have been for three years. I have made a number of friends, and I engage in many activities here—trips, games, indoor swimming, church, lodge, and volunteer charity work." I have known John for a good many years, as we both graduated from Somerville High School.

From **Richard E. Bolton** of Westmount, Quebec, Canada: "Last May 17, I attended a dinner honoring the Institute at the national club in Toronto. Our hosts were Michael H. Koerner, '49, of Toronto and Robert J. Richardson, ScD '54, of Montreal, members of the MIT Corporation. My daughter, Pamela, was delighted to accompany me, and we had a thoroughly good time. At dinner, I found myself next to a Toronto architect of Chinese ancestry and his guest, who was a visitor from Hong Kong. Dean Lester Thurow of the Sloan School gave us his views, with clarity and wit, on the probable economic trends in the early years of the next century. His predictions included a growing strength of a united Europe, the preservation of the tropical rain forests (financed by the industrial world), and a Japanese contribution to the cost of clean energy development in China. Concern for environmental needs will probably increase interest rates and inflation, he says."

I regret to announce the deaths of the following members of our class. **Louise E. Schambs,** Brooklyn, N.Y., died January 21, 1989. . . . **Anthony J. Perry,** Moneta, Va., died March 13, 1990. . . . **Henry N. Woolman, Jr.**, Pocono Lake, Pa., died April 1, 1990. . . . **Sears L. Hallett,** Barrington, Ill., died June 21, 1990.—**Karnig S. Dinjian,** secretary, P.O. Box 83, Arlington, MA 02174, (617) 643-8364, (603) 926-5363

# 30

Continuing last month's report on the 60th reunion, we have at hand about a dozen notes from classmates expressing regret at their inability to attend and hopes for the reunion's success. The principal reason given for non-attendance was poor health, with conflicting family obligations a close second. . . . In connection with the reunion, I have learned of a number of classmates who had recently lost their longtime spouses. Classmates thus bereaved included **Harvey Chapman, Phil Holt, Hal Spaans,** and **Joe Westell.**

While we did not have a class photo taken, I took snapshots at the Hampshire House dinner of those at each of our seven tables. If you would like a set of these prints, let me know. . . . At the reunion Harvey Chapman handed me an envelope containing a multi-page biography that I didn't get around to reading until I got back to Southbury. It turns out that most of Harvey's "bio," including his career at chief engineer of Evans Products, was reported in the June 1961 *Review.* Post-1961 items include his retirement from Evans in 1973, after which he and his wife Norma spent winters in Florida and summers in Detroit until 1986, when they established a year-round home in Bradenton Beach. Norma died quite suddenly last December from a rare form of lung cancer that does not show up on X-rays. The envelope Harvey gave me contained a business card bearing his name and that of Chapman & Frederick, Insurance Adjusters, thus indicating that he is still gainfully employed.

From Mount Vernon, Ohio, **Willard Morain** writes that he also is still gainfully employed, doing consulting work for his former employer, Cooper Energy Services, a division of Cooper Industries. His present assignment is technical writing and he "really enjoys being part of the work force." Willard is still an active collector of guns and coins, attends a lot of hobby shows, and swims half a mile a day at the local YMCA for a total of 2,500 miles so far. . . . **John Scheuren** writes from Hingham, Mass., that he recently returned from an extensive trip to Germany, Iceland, and Greenland, accompanied by his wife, eldest son, and youngest daughter. Of particular interest was his visit to an airport on Kulusuk Island off the east coast of Greenland, on which he had done "the exploration survey, design, and construction" in 1956-59. He found that the oil- and asphalt-treated surface is still in good condition and there is considerable commercial use of the airport.

Notices have come in concerning the deaths of three more classmates. . . . **Bart De Lorenzo's** granddaughter, Laurie Rothfuss, has passed along the information that Bart died last April 6. My records indicate that he was born on the island of Salina about 20 miles north of Sicily. During a visit to his birthplace in the mid-1960s, he found that the island's volcanic soil produces unique grapes used to produce a noted wine sold under the name Malvosia. He lived in Lafayette, Calif., where he was a manufacturer's representative doing business as Barth Engineering Co. As of 10 years ago he reported that he was living alone with a small black and white dog and finding "today's golf balls less lively than they were a few years ago and getting deader every year." My possibly out-of-date records indicate he is survived by twin sons and a daughter.

**Louis Harmantas'** death on February 2, 1987, was reported by his daughter Eleanor. Unfortunately I do not have any information about him in my records. . . . **J.A. Dixon Rapp's** death on March 5, 1990, was reported by his wife Alma. He was an architect-engineer who at the time of his death had both a home and business address in Glasgow, Ky., thus suggesting that he remained professionally active until his demise.—**Gordon K. Lister,** secretary, 294-B Heritage Village, Southbury, CT 06488

# 31

**Edward F. Coy** of Alexandria, Va., died June 2, 1989. Ed was in Course XV2 and was a member and secretary of Corp XV. He served as assistant general manager of Reading Screw Co. in Norristown, Pa.; lieutenant commander in World War II; sales manager of air armament division of Westinghouse Electric in Baltimore; vice-president of Electronic Communications, Inc., in St. Petersburg, Fla.; marketing manager of Westinghouse in Baltimore; and special assistant to the associate administrator of NASA Aeronautics and Space Technology in Washington. He is survived by a nephew, Michael Francis Coy of Redondo Beach, Calif.

**Ralph W. Hartline** died May 22, 1990 at his home in Sangerville, Maine. At MIT he was a member of the Chemical Society, Chess Club, and Dormitory Committee. He worked for General Chicle Co. in Delaware, for American Chicle Co., and 19 years for Chicle Development Co. in Sarawak, Borneo. On retirement he returned to Maine, where he was one of the original members of the Guilford-Sangerville Sanitary District, serving as trustee for 17 years until illness forced his retirement. He also served as a member of the Guilford-Sangerville Water District. and on the Budget Committee of Sangerville. He was a member of the Somerset Lodge of Masons in Skowhegan and is reported to have been an avid bridge Player. He is survived by his wife Mary H. Hartline. Donations in his memory may be made to the Goodwill Home Association in Hinckley, Maine.

**Richard R. Snow,** who entered MIT his junior year in Course II, died at a Bellevue, Wash., nursing home on May 10. He was an engineer for the American Steel and Wire Co. division of U.S. Steel for 37 years. He is survived by his wife Edith, two sons, and a sister. Like most natives of Rockland, Maine, he enjoyed sailing; the private funeral services were held on the family sailboat off James Island in the San Juan Archipelago, and memorial donations are suggested to be sent to Mystic Seaport in Mystic, Conn.

**Lawrence Stauder** died February 27 in South Bend, Ind. He was professor of electrical engineering at the University of Notre Dame for many years, and his family is grateful for contributions to the Lawrence Francis Stauder Prize-Scholarship at the University of Notre Dame. He is survived by his wife Dolores W. Tantoco-Stauder.

**James A. Wilson** died August 20, 1988. He worked as plant manager at Monsanto Chemical Co. in Everett; production manager at International Minerals & Chemical Co. in Bartow, Fla.; works manager at Kaiser Aluminum Co. in Baton Rouge, La.; and market development manager at Kaiser Chemical Co. in Oakland, Calif.

Our sympathy goes out to the families of these members of our class. As for myself, I manage to stay busy in my yard and garden, as well as keeping up with my golf game, the local historical society, and our local chapter of SAME, plus those things that call me back to my old law

1907-1990

# Kenneth Germeshausen
## *The Quiet Inventor*



He was quiet, reserved, almost shy and diffident. But Kenneth J. Germeshausen, '31, who died at his home in Weston, Mass., on August 16 at the age of 83, was the principal author of technology that transformed a struggling consulting partnership into EG&G, Inc., a major Massachusetts high-tech corporation. And beginning in the 1960s he was a steady-handed supporter and adviser of MIT, loyal and generous almost to a fault.

Germeshausen came to the Institute from California in 1927. As a student in electrical engineering, he soon came under the influence of Harold E. ("Doc") Edgerton, '27, with whom he did a thesis using strobe lights to study the behavior of a large electric motor. Both received degrees in 1931 at the bottom of the depression—Germeshausen his bachelor's, Edgerton his doctorate. By then Edgerton's place at MIT was assured, but Germeshausen ended up without a job.

At Edgerton's suggestion, Germeshausen joined him in a partnership that would apply strobes to industrial problems such as the one that inspired Germeshausen's thesis. Their enterprise was modestly successful—enough so that two years later they made room for Herbert E. Grier, '33, thus assembling the three names that became so familiar.

In addition to consulting, Edgerton and Germeshausen continued studies on generating and measuring high-energy electrical pulses. Some of Germeshausen's results proved basic to the development of firing mechanisms for the atomic bomb, and the pace of the partnership's work quickened in the 1940s. As a result, the Edgerton-Germeshausen-Grier partnership went public in 1947 as EG&G, Inc., with Germeshausen as vice-president and treasurer. He became president in 1954 and chairman of the board in 1965, continuing as a director and consultant after retiring in 1972. EG&G is now a "Fortune 300" company with 30,000 employees worldwide. Germeshausen held 50 patents on which much of EG&G's work is based, and in 1989 he was the New England Inventors Association's "Inventor of the Year."

Germeshausen's interest in his alma mater and in the interface of humanitarian concerns with technological advances led him (with his wife Polly) to endow MIT's Germeshausen Professorship in 1968. Thereafter, he was a member of the Council for the Arts at MIT (1974–1988) and of the visiting committees to the humanities (1969–72 and 1980–85), the arts (1972–75), and nuclear engineering (1980–83). He was elected to the Corporation in 1980.

Germeshausen was vice-president of the Alumni/ae Association in 1971-72, and he was chair of the Alumni/ae Fund Board in 1976-78. He received the Association's Bronze Beaver Award in 1975. Following his success as chair of the gift committee for his class's 50th reunion, Germeshausen was made honorary president of the class of 1931. The partners' personal contributions were added to those of EG&G to make possible a new building for the Department of Electrical Engineering and Computer Science in 1984. Two years later Germeshausen received the Corporation Development Committee's Dalton Award.

Germeshausen may have been, as he said at the 1984 building dedication, "green as grass" when he arrived at MIT and "studious, rather reticent, and fond of his pipe" (words from his own biographical sketch) while working as an unpaid research affiliate in 1934. But by 1975 the Alumni/ae Association (in its Bronze Beaver citation) described him as "one of [MIT's] most effective, astute, and informed advisers," a tribute that was to be fulfilled even further in the decade that followed.—*John Mattill* □


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office, particularly when someone wants to know something about an old title (really old—say 200 years).

These past few months, I have been to several luncheons with other MIT alumni/ae, but none of our classmates were there. In October, Mildred and I will be off to St. Louis to a reunion of the army engineer outfit I joined in September 1941 and left in August 1945.—**Wyman P. Boynton,** secretary, 668 Middle St., Portsmouth, NH 03801

# 32

**Tom Weston** had two memorable experiences recently. The first was shaking hands with Valentin Lebedev, who lived in space for 211 days, when he was giving a lecture at the Boston Museum of Science. Tom also had met and talked with Yri Gogain, the first human in space, and had interviewed Neil Armstrong, the first man to walk on the moon.

The second once-in-a-lifetime experience for Tom was going to a Red Sox game with Rose and his son where he saw the Sox make two triple plays in one game, the first time ever. This reminded him of the time he was playing second base for his high school team and made all the putouts on a triple play. He describes it: "With men on first and second and none out, the batter hit a line drive at the pitcher. He stuck out his glove, deflected it toward me heading toward second base. The ball landed in my glove for out one, and I stepped on second for out two. I tagged the man running from first base for the third out and trotted over to the bench and was seated before my teammates and the umpire figured out what had happened."

Commander **Leo T. Tyburski,** U.S. Navy (retired), writes that his ship's company had a great reunion in Chicago. Each year this event is held at a different location. He heard from **Jack Kearns** who lives in California.

Any class member who wishes to obtain an up-to-date mailing address and phone number of any classmate may do so by calling Alumni/ae Records, Ms. Fran Diamio, (617) 253-8261.

Professor **M. Holmes "Steve" Hartshorne** died after a difficult illness in May 1988. His colleague at Colgate University wrote an excellent eulogy on Steve in the Colgate alumni publication. From this I gleaned that Steve was the rare teacher and individual who faced life and death with complete intellectual honesty. In life he did not think faith and doubt were opposites but saw them intertwined in the common experience of intelligent persons. He faced his difficult end without illusion; he felt that without suffering there is no joy; and he was confident in the greater reality that we can neither understand nor control but can only accept. He leaves his wife, Ruth, fours sons, and a daughter.

**Joseph D. Eisler** died in March 1990 after a lengthy illness. He was a geophysicist. He retired from AMOCO Oil Co. in 1971. He leaves his wife, Bertha, a daughter, a son, and three grandchildren.

The Alumni/ae Association has forwarded the following news. When I receive obituary information, I will forward it to our classmates. **Edgar Wright** died in 1985 in Los Angeles; **Jose D. Murga** died in January 1990 in Mexico City; **Howard Carver** died in April 1990 in Rochester, N.Y.; **Thomas Regan** died in January 1989 in Naples, Fla.; and **Gertrude Deutsch** died in 1980 in Portland, Oreg.—**Melvin Castleman,** secretary, 163 Beach Bluff Ave., Swampscott, MA 01970

# 33

Your secretary, identified below, reports that he has received no news from nobody about nothing since last issue. Ain't you ashamed of yourselves? Please communicate with—**Bill Klee,** secretary, P.O. Box 7725, Hilton Head Island, SC 29938

# 34

Please send news for this column to: **Robert M. Franklin,** secretary, P.O. Box 1147, Brewster, MA 02631; **George G. Bull,** assistant secretary, 4601 N. Park Ave., Chevy Chase, MD 20815

# 35

I regret that you found the class notes for 1935 missing in the last issue of the *Review,* the first time in almost 30 years since I was elected to the office.

The most important thing I can now tell you about is our 55th reunion. Sixty-two classmates with wives and friends attended and reported that they had a great time. Bernie sent me one of the hats that was given to everybody there. The principal shortage showed up when we had a four-oared crew on the river Thursday morning instead of the usual eight. **Don Wood** rowed at stroke, **Bob Olsen** was behind him at no. 3, **Stocky Stockmayer** rowed at no. 2, and **Will Grosser** was the bow man. Our coxswain was **Tom Tiffany,** the women's varsity coach. Our thanks to Stocky who, on very short notice, put this group together. I heard the Pops was superb as usual.

At the class meeting at Wianno on Sunday morning, the following officers were elected to serve until June 1995: **Bernie Nelson,** president emeritus; **John Taplin,** president; **Goffe Benson, Thonet Dauphine,** and **Leo Dee** (vice-presidents); **Randy Antonsen** and **Henry Kimball** (treasurer and assistant treasurer, respectively); **Hal Bemis,** class agent; and **Leo Beckwith,** estate secretary. Special thanks were extended to Janice Dee for her vocal entertainment.

There was considerable discussion about location for our 60th reunion in 1995 and, although no decision was made, advance reservations will be made at Wianno. There was general agreement that an updated class director would be helpful in keeping up interest in future events. **Ed Taubman** was given a vote of thanks for his VCR tapes of the past two reunions. **Mack Kleiman** suggested we have a historical committee. Since I probably have most of the necessary information, I am asking my former lab partner, Mack, to write to me with his suggestions for committee members and procedures. I talked to **Don Wood** and learned that he and his wife enjoyed the reunion very much and spent the Sunday night with Bernie before going on to visit friends on Long Island, in Saybrook, and Wakefield before flying home, Don is doing some very interesting things in woodworking.

The Alumni/ae Association sent me a number of deceased alumni sheets, most of which have attached obituaries. However, the first one does not. **Albert deRoode, Jr.** died September 8, 1988, in Kaneoche, Hawaii. His closest survivor is a sister, Elizabeth deRoode living in Toronto. . . . **Lowell J. Lammers** died November 3, 1989, in Baytown, Tex. He received his degree in architecture and was registered in a number of states. He lived in Baytown for the past 48 years and was designer of many of the city's municipal buildings. He was a member of the American Institute of Architects, the National Society of Professional Engineers, and the American Academy of Science. He is survived by his wife, Jean, one son, and two daughters. . . . **Frank P. Wilkins** died April 15, 1990 in Symmes Hospital, Arlington, Mass., after a long illness. He served as a first lieutenant in the Army Artillery and joined the MIT Flight Instrument Lab in 1946. He then joined General Electric, and on his retirement in 1977, he was manager of government contracts. He is survived by his wife, Mercia, two sons (Capt. Frank S. Wilkins, U.S. Naval attache in Helsinki, and John P. Wilkins of Wellesley), one daughter (Nancy Strickland of Lynnfield), and four grandchildren. . . . **Kenneth M. Warren** died June 28, 1990, in New London Hospital after a lengthy illness. During World War II, he served as a lieutenant in the U.S. Navy. He worked 38 years for Allendale Insurance before retiring in 1974. He is survived by his wife of 54 years, Elizabeth, of Warner, N.H., one son, one daughter, and six grandchildren. I received a memorial card from his good friend, Walt Wojtczakk, '37. Send letters!—**Allan Q. Mowatt,** secretary, 715 N. Broadway, No. 257, Escondido, CA 92025

# 36

Continuing from last issue, when I visited **Bob Boden** in May he was still under treatment for a 1989 retinal separation, but could read and drive. In 1932, driving from Montana to the Institute in a Model A, he followed the car tracks in Cambridge per advice of a pedestrian, and wound up part way into the EL tunnel. Cartoonist Dahl made humor of it the next day, portraying an underground filling station. Three years later Bob got attention of a sort from Karl Compton: tuning can experimental supercharged engine, Bob unknowingly created a supersonic blast that rattled windows in the president's office and as far away as Kendall Square! Bob is a problem solver of the first order: Early in World War II, the first P-38s produced had a tendency to roll out of control and several pilots were killed. The designers were at a loss to find the flaw. Bob studied the production procedures and came up with the answer: nothing wrong with the designs or components, only the temperatures in the hangar buildings where wing spars were assembled. Without air-conditioning the thermometer rose with the sun—20 to 30 degrees between start and finish of a spar—and a warp was built into the wing as components were added at different temperatures.

In rocket work much later, Bob pointed out a flaw that caused a rocket to blow in a test for visiting brass. After the hubbub subsided and the military left, Charles Lindbergh came forward—"May I talk with you about it?"—and they did, at length. To quote Bob: "Lindy knew his stuff, and how to deal with people." This is the third such experience by '36 classmates mentioned in class notes, and all have been favorable. Bob's career in aerospace physics and engineering included Lockheed, Jet Propulsion Lab at Cal Tech, Rocketdyne Division of North American Rockwell, and the University of Michigan. In 1958 he won the Manley Memorial Award of S.A.E. for design of aeronautical power plants.

A long-standing invitation from **Bill "Slim" Beckwith** to visit the San Diego area was answered in July. This trip was via Southwest Airlines, whose rates for senior citizens are less than the cost of gasoline for the camper. And what a fruitful trip! Too many visits to report in one issue, so I will list all the names and spread the news into January. . . . At a luncheon in La Jolla, arranged by Slim at La Valencia's Sky Room, were **Bob Lutz, George Webb,** and Slim. At their homes I saw **Al Del Favero, Doug Hawks, Brent Lowe,** and **Albert (Ken) Romberg,** and by telephone I reached **Howard Anderson, Tony Hittl, Bill Lewis,** and **John Sharp.**

Bob Lutz and Elizabeth provided bed and breakfast, the latter big and hearty for me; lean and diety for them. Bob has added some waistline recently, and doesn't qualify for 150-pound-crew—but maybe in 1991. He was with Convair in the 1940s, dealing with all kinds of problems and evaluating ideas and equipment. For a while he, Lester Moffatt ('35), and Norm Robbins ('37) were together at the Fort Worth installation. Then from 1949 to 1956 Bob traveled for the Rand Corp. visiting the major aircraft builders in the country to get consistent and comparable evaluations of their products for the Air Force. He spoke of **Dick Murrow** (Course XVI), who also was at Rand's Santa Monica office, and he saw **George Ray** at Langley, Va. Bob and **Kelly Woods** (X-A) were schoolmates at Kansas City High, met up again at ROTC in 1932-33 (Kelly had been at Stan-

ford meanwhile), and then not again until POPS at our 50th reunion. Bob has been tutoring junior high school students in mathematics the past four years and finds it stimulating and satisfying.

**George Webb** (Course X) could almost roll out of bed downhill to our luncheon, but he walked for exercise. His work was in nuclear research and engineering with Kellogg, Kellex, and General Atomic. He published several papers on hydrocarbon research jointly with Professor Benedict at Kellogg, and earned a listing in American Men of Science. **Henry McGrath** and George were together at Kellex. George sails a 26-footer in San Diego harbor, and out into the ocean when conditions are right, but beware—there aren't many hiding places if you can't make it back before a squall. George and wife Elizabeth have crossed the country three times with their six-wheel trailer, and once were saved from an accident by an alert truck driver. One wheel was about to go its own way, wobbling loose from its axle.

**Slim Beckwith** not only arranged the luncheon—he also got directions and telephone numbers so I could visit or call those unable to attend. Our association started with three and a half years of crew, which carried on to workouts on the Charles at the 40th, 45th, and 50th reunions. Slim was Course IX, and Professor Hudson got him interested in meteorology. At graduation time, the airlines were just striking out for themselves in this field, and United ferried him to Oakland in a 10-passenger Boeing for a mutual appraisal. All to the good (a career of 40 years and honors), but he was delayed in Salt Lake City on the way back and missed graduation. His work brought him in touch with **Bernie Vonnegut** at one time, doing lightning studies near Socorro, N.M. And, when the chairman of United had a big garden wedding for his daughter, on request Slim forecast conditions for the day—showers, but not until 3 to 4 pm—and he hit it on the nose! Slim retired in 1976, but not quite. He is called into court from time to time as an expert witness on climatology, and in 1987-88 made five trips to Portugal to teach pilots and safety directors. This was sponsored by Air Portugal, the airline Phoebe and I flew to the Algarve last April.

**Bill Lewis** had planned to be at the luncheon, but complications that morning prevented it. He joined the class in Course X as a graduate student from Notre Dame and Armour Tech. For many years he was in tar-products manufacturing and contracting in Illinois—as engineer, executive, and member of the board. Later he was executive director of the Rockford Housing Authority. Retiring to California in 1977, he dabbles in real estate and golfs frequently. Bill and wife Louise celebrated their 50th anniversary last year. Another highlight was entertaining the town crier of London when he came over to attend a benefit ball run by their daughter. The mayors of San Diego, Oceanside, and other cities honored the occasion.

**Brent Lowe,** Course XV and very active at the Institute, also hoped to be with us at lunch, but the aftereffects of chemotherapy and radiation prevented it. In his words he is "a 14-year survivor of throat cancer," and to my mind he is a living example for Dr. Siegel's *Love, Medicine and Miracles*. In Brent's case it is the love of his daughters and grandchildren, friends and classmates. We went through much of the class directory, and name after name brought to his mind personal experiences and recollections: **Claxton Monro** was his thesis partner senior year. Came the war and Brent was a navy lieutenant in the Bureau of Aeronautics, and planning to marry in 1944. By this time Clax had left engineering for the ministry, and was assistant to the rector of Calvary Church in New York. So Clax married his thesis partner! At a test of rockets Brent saw **Charlie Hobson.** In recent years he met **Bob Hannam** at a Campaign for the Future lunch, and President, **Alice Kimball** visited on one of her cross-country camping trips. Brent took the Thorn-Loomis industrial tour to Europe in 1936, and now recalled fellow tourists **Henry Johnson, Norm Copeland, Jack Ayer, Jack Coffin, Aaron Loomis**—I should have had a tape recorder to get them all.

You would be heartened to talk with Brent—(619) 459-6105. He speaks of himself as a Rube Goldberg contraption: a treatment helps the target area but produces a side effect; another treatment helps that but causes a different problem, and so on. But his voice was strong and only slightly raspy when I saw him, and his good humor and strong handshake belie any illness. It was an uplifting experience.

From Alice came a July 29 clipping of the *Hartford Courant* Sunday business section headlined "Manufacturing guru made his reputation on the factory floor," with a picture captioned "**Dorian Shainin** has brought his reliability system to bear on everything from the F100 jet fighter engine to the lunar module for the Apollo moon landing." His "methods have been employed by hundreds of companies, including Pratt & Whitney, Digital Equipment. . . . " The article goes on to quote the director of quality control of General Motors central foundry division: "We have been able to use his techniques to solve problems we could not solve using other methods." And, quoting Dorian: "When you're talking about manufacturing, the problem almost never turns out to be the attitude of an employee. It's either going to be a problem of design or materials or tooling, vibrations of humidity or maybe incorrect specifications." **Bob Boden** and Dorian would have a ball together at the 55th reunion next June.—**Frank Phillips,** secretary, 1105 Calle Catalina, Santa, Fe, NM 87501, (505) 988-2745; **James F. Patterson,** assistant secretary, 170 Broadway, Pleasantville, NY 10570, (914) 769-4171

# 37

**Harry Corman** is semi-retired (he works about one day a week). Wife June's main interest is tennis and she also does volunteer hospital work and is a guide at the Montpelier, Vt., State House. Last year Harry completed 50 years of private and Army Air Corps piloting. Harry writes, "My brother and I still own the 250 Comanche and I am still playing tennis in what I call the pacemakers' league. Two of the players have pacemakers. After reading your note about you and **Len Seder** being in a retirement community, June and I suddenly realized that we are getting older and are lucky that our health is now good but know this cannot go on forever and must make plans about living the rest of the way. We will be back in Vermont May 1 and then I will be getting the airplane back from my brother, who keeps it during the winter months at the Norwood, Mass., airport."

**Thomas F. Hennessy** is semi-retired from his private practice of architecture and is a consultant to the American Hotel/Motel Association. His wife Kathryn's main interests are entertaining, reading, water colors and piano. Among his hobbies are sketching in different media, board of directors at PGA (architectural controls), golf at PGA (23 handicap), reading, swimming, and walking, and he is now taking a course in CAD computer. Son Paul is director of communications at Santa Clara with a family of four, and daughter Joan is teaching with a family of three. . . . **E.T. Herbig, Jr.,** retired as sales manager of E.F. Johnson Co., Waseca, Minn., in January 1965. He is interested in local, county, and state politics. Wife Elaine is involved in hospice work, the volunteer local nursing home, and the local Episcopal Church.

Ruth and **Bob Thorson** traveled to Florida the month of March. While there they visited Martha and **Joe Smedile,** who live in Del Ray, Fla. They are doing fine and he is busy with his condominium association and is president of the MIT Club of Palm Beach. Bob writes, "we spoke to Elvie and **Norm Birch,** who live in Lakeland, Fla., and are busy and involved in their community. Rose and I had cocktails with Ruth and **Phil Peters,** Janet and **George DeArment,** Catherine and **Charlie Kahn** at Alice and **Win John**'s home in North Palm Beach. Following cocktails we had an enjoyable dinner at a nearby restaurant. Everyone looked and felt in fine shape (forget the normal aches and pains of getting up in the morning with a charlie horse, spending all day with arthritis, dining with will power, and going to bed with Ben Gay). Phil informed us that he expected Marge and **Dick Young** to be in Florida at the end of the month and that plans are still on for the 55th reunion to be held in Newport, R.I."

**Dick Young** wrote a while back: "Within a few weeks our 55th planning will get under way with the class officers and wives coming down here to Newport for a day. Marge and I have just returned from a quick visit to see 'friends of long standing' down in Florida. (We do not call them 'old friends'!) We stayed a few days with Ruth and Phil Peters at Palm Beach Gardens, Fla., where they have the use of son Phil's lovely home. While I was there I was blessed with a nice 75th birthday party that included Alice and Win Johns, Janet and George DeArment, the Peters, and Youngs. We have known all of these fine people since before we were married. What a wonderful gathering, thanks to Phil.

"We are lucky to be able to go off in mid-May for several weeks in Scandinavia, starting with the famous Bergin Line's cruise up and down the northwest coast of Norway. Then by train, bus, car, etc., around Norway, Sweden, and only Helsinki in Finland. Three other couples (non-Tech) are in our group. Son Dick, a Babson grad, is starting a dynasty; Matt is finishing his freshman year, and Becky has received advanced acceptance there. We are getting our formal education from the Greater Boston area; parochial but good from the point of keeping our family together. Son Steve continues as a partner and trial lawyer with a fine Boston firm, but Pam, who never married and is the second beauty in the direct family, is devoted to Denver. Guess one can't win them all."

I regret to report the death of **Sydney B. Karofsky** (17 Blake Rd., Weston, MA 02193) on June 14. Sydney was an accomplished artist, architect, and interior designer. He was 75. Sydney was born in Boston, graduated from English High School in Boston, and received an SB in architecture from MIT. He founded and worked for Northeastern Wallpaper for 41 years before retiring in 1988. In 1943 he received a patent for "Dimensional Walls," a series of geometric designs. He also designed the Hillel House at Boston University. He was a past president of the International Wallcovering Distributors Association and a past vice-president of the National Association of Wholesaler Distributors. In 1975, he received the Allman award for extraordinary contributions. Sydney was a past president of the MIT Stein Club, the Hillel Foundation at Boston University, and the Hebrew Rehabilitation Center. He was a founder of Brandeis University and a sustaining fellow of MIT. He also was a member of the Copley Art Society, Temple Israel of Boston, the Charles River Yacht Club, and Pine Brook Country Club of Weston. He was a former member of the Port of Boston Business and Industrial Development Committee. He leaves his wife, Sylvia (Dulman); two sons, Peter of Madison, Wis., and Paul I. of Weston; two brothers, Mark of Weston and Alfred of Wayland, Mass.; and five grandchildren.

I also regret to report the death of **Harry W. Janson** (67 Pilgrim Ave., Fairhaven, MA 02719). His son, William Janson (25 Rossini Rd., Londonderry, NH 03053), writes "My father passed away on November 14, 1989. He was 75. He was a retired design engineer with Hoyt Manufacturing Corp. of Westport, Mass.

Class news is again drying up. If you send out a Christmas or season's greetings letter to your friends, *please* send me a copy, edited if you wish. It would be most helpful.—**Lester M.**



*Aboard a cruise ship off the coast of Norway, (from left) Ira ('38) and Louise McKinney Lohman, Dick ('38) and Louise Arkansas Muther, Walt ('40) and Mary Margaret Lohman Helmreich, Al ('38) and Carol Doty Wilson, are living proof of the success of intercollegiate marriages and longevity of college friendships. The men all belonged to Beta Theta Pi and married Wellesley graduates. Other '38ers in the Beta-Wellesley connection are Bob and Brownie Wheeler Eddy, Newt and Hilda Morrison Hammond, and Don and Betts Winderle Weir.*

Klashman, secretary, Brookhaven at Lexington, 307A, 1010 Waltham St., Lexington, MA 02173, (617) 862-4859

# 38

Every issue contains accounts of our travels, and this is no exception: **Horace Homer** took time off from presidency of the MIT Club of Cape Cod for a trek with Roberta through the Canadian Rockies, a cruise on the *Star Princess* to Juneau, and an AARP trip to Skagway and Ketchikan. . . . **Norm Leventhal** left the Beacon Companies with the MIT Corporation to follow Muriel through the Greek Islands, Istanbul, and Switzerland. . . . Louise and **Ira Lohman** added to their collection of over 20,000 travel pictures during their trip to Norway, which was their 12th trek to Europe. Ira still flies his Beech Bonanza around North America. . . . The **Hadleys**, returning from their three-week Elderhostel tour in Ecuador followed by a week in the Galapagos Islands, strongly recommend the Galapagos cruise, including the excitement of hopping on and off the ship's launches for island visits. It was a revelation to see Darwin's theories practically in action.

**Yale Brozen** has been elected to the board of the Robert Pharmaceutical Corp. . . . The **Severances** recently visited **Ruth Black** in Damariscotta, Maine, and they report that she is comfortably ensconced in a beautiful retirement community. . . . **Al Cushing** joins **Ed Hadley** on the board of Northern Essex Elder Transport, a neat coordinating group of volunteer drivers in 11 communities in one corner of Massachusetts.

It's still not too early to set aside the second week of June 1993 for our 55th reunion. We particularly recommend it for those who have never shown up before—to renew old friendships, to make new ones, and to see the changes in the Institute. Every time I go up the steps at 77 Mass. Ave. that were new when we were there, I'm impressed by the deep grooves worn in by 50 years of students. The reunion committee is already hard at work—it consists of chair **Haskell Gordon, Don Severance, Lou Bruneau, Dave Wadleigh, Paul O'Connell,** and **Frank Gardner.** We plan to leave Cambridge by bus for Martha's Vineyard on Tuesday, June 8, stay at the Harbor View Hotel until Thursday, and then return to Cambridge for the Pops concert and Technology Day activities, winding up on Saturday, June 12. Besides the harbor view and the friendship renewals, the hotel provides golf, tennis, nearness to shopping, ocean swimming with the **Jelatises**, and numerous **Bruneau**-led activities.—**Don Severance,** secretary, 39 Hampshire Rd., Wellesley Hills, MA 02181; **Ed Hadley,** assistant secretary, 50 Spofford Rd., Boxford, MA 01921

# 39

**Eli M. Dannenberg** was awarded the Medal of the Societe Francaise de Chemie for contributions to the science and technology of rubber and carbon black. The award was announced during the International Rubber Conference held in Paris last June. Dannenberg is a councilor of the Rubber Division, ACS, and a past chairman. In 1984, he received the Rubber Division's Award of Technical Excellence. During his career with the Cabot Corp., he held the positions of scientific director, corporate research fellow, and vice-president of research and development. Dannenberg earned the degree of Docteur es Science from the University Louis Pasteur de Strasbourg in 1973. He is author and co-author of 90 publications and 13 patents, mainly in the field of carbon black technology.

**Dick Blake** relayed a clipping from the *IEEE News* that **Harold Chestnut,** president of the Swiis Foundation, will receive the Richard B. Emberson Award "for leadership and dedication to the institute's technical growth and service worldwide, and for the development of systems engineering concepts." Since our 50th reunion, Dick and Ginny traveled in Europe and the U.S. When at home in Pittsburgh, they participate in SCORE. . . . **Fred Grant,** chairman of our 55th reunion committee, and Ginny sent a July 2 *Boston Globe* photo of Dora Stanton "nailing a point" at croquet and husband **Paul Stanton** smiling his congratulations from nearby. . . . Fred also relays that **Seymour Sheinkopf** and Sylvia traveled in their camper to the Northwest. They phoned from the Rain Forest on the Olympic Peninsula.

**Bob Withington** and Betsy, **Jim Barton** and Mary, and Hilda and I heard an eloquent presentation by MIT President Paul Gray, '54 last May in Seattle. Paul outlined recent accomplishments and compelling challenges at the Institute. . . . **George Cremer** phoned that he survived the cinders during a 150-mile trip on a train pulled by a steam-powered locomotive in the Rockies. In San Diego, George assists a team of experts who are sorting through many barrels of unused aviation engine parts. They hope to find enough parts to assemble one (or all three) engines used to power a tri-motor airplane built in 1928 (on display in San Diego's aero-space museum). As we spoke of sports, George recalled the star of our class football team, a running back named **Harold Muckley.** George was quarterback and believes he received more than his share of bruises mainly because our scouts underestimated both the weight and attack-speed of a '38er named Cook, who during this particular Field Day game was dedicated to demonstrating impact effect due to conversion of MV-squared.

**Aaron White** is arranging his collection of famous jazz music. He thoughtfully sent an hour-long tape of his favorites. Included were splendid segments by Billy Novack and Guy Van Duser, who entertained for two days at our 50th reunion. Aaron and Edith invited '39ers to write on jazz and on "an easy way to really understand a home computer beyond its word-processing capabilities."

Classmates **Morrie Nicholson, Win Reed,** and **Fred Cook,** who led our late-evening singalongs at reunion, may know that **John Alexander** and Nancy joined Hilda and me to attend an outstanding concert in Tacoma. Featured artists included the Goodtime Singers (a barbershop champion quartet from Sweden), the Rostov Four (a barbershop quartet from the USSR), the Growing Girls (1989 Sweet Adeline champions from Sweden), and the Most Happy Fellows (1977 International SPEBSQSA Champion Quartet from Tacoma).

**Morrie Nicholson** and Fred Kolb, '38, are touring the Canadian Rockies and Alaska and expect to visit classmates in Seattle during September. . . . **Jim Barton** and Mary plan to celebrate their 50th wedding anniversary on September 18 at their lovely home on Lake Washington. . . . **Bob Touzalin** writes about travel adventures he and Aletta shared last summer. He had to learn to drive on the left side of the street in London. Longtime friends in England loaned Bob and Aletta their second auto, which (after the first 200 miles) blew its top. They replaced the engine and resumed travel. The next day, Bob was hit by a van and suffered a broken ankle, a cracked rib, and bruises, all of which enabled him to become acquainted with how socialized medicine really works. After several weeks of recuperation, they joined other friends for a trip on England's scenic canals. It turned out that the husband had a bad back, so neither man was able to do physical work. Therefore, the men steered the boat, and the ladies operated the locks on the canals. Attempts to obtain Aletta's confirmations resulted in no answer to the Touzalin's phone in Florida. To meet the *Review*'s deadline, we offer our unconfirmed theory that these two intrepid mariners are undaunted, peripatetic, and afloat someplace. More on the Touzalin saga after we get confirmed facts.

We are saddened by news of the deaths of two classmates: **Donald W. Waterman** of Easton, Conn., on October 10, 1989; and **William Alexander Davis** of Lincoln, Mass., on May 26, 1990. There were no details.—**Hal Seykota,** secretary, 1701 Weatherswood Dr., NW, Gig Harbor, WA 98335

BY SANDRA KNIGHT

# A Busman's Retirement

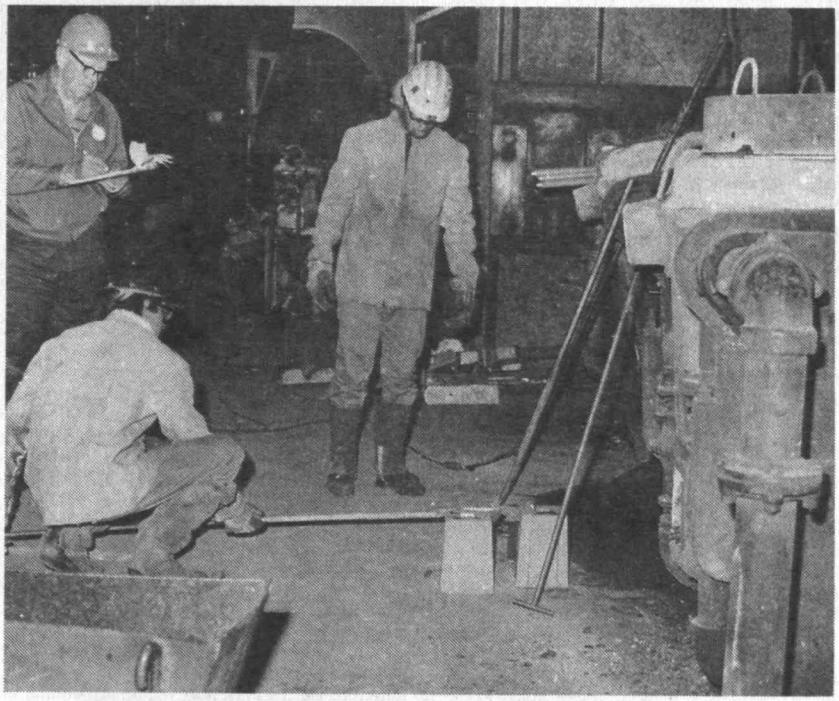
Norman Birch, '37, is retired. But with 50 years practical and professional experience in the American metal casting industry, he found he couldn't say no to one more challenge in a foundry. So when he was contacted by the International Executive Service Corps (IESC), a kind of specialized senior Peace Corps, he was definitely interested.

The IESC was looking for experienced executives, usually retired from U.S. firms, to serve in the developing countries as volunteer advisers to locally owned enterprises who request managerial or technical assistance. Their ideal volunteer executive is a good ambassador and teacher, who has a record of success in a field important to the economy of the country of assignment.

IESC, a not-for-profit organization developed in 1965, has completed more than 12,000 projects in 90 countries. It reviews requests for assistance from member countries and selects those that appear to have the most merit and have requirements that can be met. Then the IESC matches their need with a U.S. executive who has the expertise and can spend two or three months in a foreign country helping the client. The executive receives no salary, but all expenses are paid.

IESC found him, says Birch, because of his particular expertise. CSN, a steel mill in Volta Redonda, Brazil, needed help with improving production techniques for casting blast-furnace parts in high-conductivity copper. And Birch had previously worked as a consultant with a foundry in São Paulo, so Brazil was familiar to him.

To make the best use of his time there, Birch made initial assessments before his departure. What did the Brazilian steel mill's operation currently need? Could Birch bring instruments that were easier and cheaper to buy in the United States? How sophisticated were the client's current operations? If the mill's casting designs were outmoded, the client might have to reassess his needs in order to achieve his ultimate objective.



*As part of an International Executive Service Corps project, Norman Birch, '37, volunteered his services for six weeks to CSN, a Brazilian steel mill in Volta Redonda. His object was to improve production techniques for casting blastfurnace parts in high-conductivity copper. In the furnace (above right), copper has been melted, and the melter is pouring test samples. Birch (above left) uses a clipboard to keep the melt log. Next, the solidification characteristics of the test samples must be evaluated.*

Birch and his wife, Elvie, were in Brazil for six weeks. "The people were very friendly and very much like doing business with North Americans," says Birch. His IESC assignment was not a vacation. Five days a week Birch was up at 6 AM, to the foundry by 7:15, on his feet most of the day, and back at his hotel by 6 PM. But he found the work interesting, it was rewarding to see the results, and he and his wife were able to spend weekends seeing the sights. He concluded that IESC is performing a much-needed service by forming a link between the United States and developing countries.

Other alumni/ae have also found IESC to be a satisfying experience. Edward Bronstien, '51, and his wife, Rosemary, traveled to Guatemala City last winter. As former president of United States Bedding Co. in St. Paul, Minn., Bronstien was well qualified to share his business knowledge with Ultra Industries, S.A., a small but growing mattress and furniture company. And Winslow Hartford, '30, spent six months between 1987 and 1989 as a volunteer in Bombay, India, consulting with government and private industry on energy, water supply, and environmental regulation.

Readers interested in learning more about the International Executive Service Corps can write to IECS, P.O. Box 10005, Stamford, CT 06904 □

# 40

**Richard Powers** and wife Frances returned in May from a five-week trip to visit friends in Paris, and to travel to Aix en Provence, Nice, and Innesbruck. They finished up with nine great days in Greece and Crete, where they were "continually amazed by the ingenuity of our forebears." . . . On June 11, **Walter Schuchard** wrote, "Our second oldest granddaughter was married June 2, which started a hectic 10 days—reunion Monday through Friday, a party for 210 people Saturday, and a birthday party for Peg and me on Sunday.

Outgoing class president **Jim Baird** sent me a reprint of an article from the June issue of *American Laboratory* dealing with the Hubble Space Telescope. In part it says, "One striking aspect of the program was that after the design had been determined, some elements of the Space Telescope could not have been built had not new technology become available over the course of the project. Not the least of these were computer-controlled mirror-polishing techniques that were refined at Perkin-Elmer in the mid-1970s by **Richard C. Babish.**

Three decades earlier, Babish had been the key engineer in the development of Cinerama at Paramount News. The mirror technology for the Space Telescope would be one of his most critical contributions during a distinguished career devoted to electro-optics."

There is one death to report. **Hrant Isbenjian** of Stamford, Conn., died suddenly on May 15. A letter from the executrix of his estate says that he left no survivors.

A post-reunion letter from **Wesley Pendleton** states that, now that it is over, he has survived, but it took several weeks to rest up. He lost a medal from IEEE with the words "AVANT GARDE" on the pendant, and a light blue ribbon on the top. If anyone, by chance, found it, please send it to him at 1542 Clinton St., Muskegon, MI 49442.

**Jim Baird** sent a note to the Reunion Committee to thank them for their contribution, and to comment on the good time had by all. He believes it is the first time that no rain was encountered during any of the events. He felt that the format of attending Commencement, going to Mystic, and then returning to Cambridge, worked out well. I agree! As a follow-up on last month's comment of appreciation to Alumni/ae Association staff members, **Edgar Bernard** sent me a list of their names : Eliza Dame, Beth Garvin, Sue Downey, Chris Fogglia, Sue Powsner, and Bob Blake. Thanks to them all once again for the many services they provided to make our reunion a success!

A card from **Joseph Paine** of Baltimore, Md., expressed his regret that he and Anne were unable to be with us at the reunion. They had hoped to attend, but problems developed to prevent their coming.

Jim Baird had a letter from **George Niles** of Idyllwild, Calif., where he is building additions on his house at its 6000-foot elevation. He spent many years with Monsanto, some of them in Everett, Mass., and others spent traveling for months at a time, plus a three years stint in Europe. He believes that Idyllwild is the best compromise in southern California for retirement. He sent us good wishes for the reunion.

A letter from **Alvin Guttag** notes that he is probably the only class member who attended all 10 of the reunions to date. I wonder if anyone can match that. He had a great time, and congratulates Dick Babish on a job well done. He says that his jogging at the reunion paid off, as he won the 70 and over division of the Komen Washington Race for the Cure (against breast cancer) on June 16. Al also reminisced about his 25 years as class secretary. During that time he was censored twice—and for the same story both times. He included it in his letter, but as it deals with an incident of 30 years ago, it did not seem timely to include it.

From the 50th reunion edition of the 1940 *Technique,* I shall quote some of the biographical comments in this and in future columns. They will be chosen more or less at random, and inclusion or exclusion has no editorial significance.

**Alfred Wu** wrote, "Coming to MIT was the best thing that happened to me, at that time, but it was not planned. A student demonstration at Tiananmen in December 1935 led to my leaving China, and eventually entering the class of '40. It was fate, and I am grateful." And this was years before the Communist ascendance in China! Does history repeat itself? Al further writes that he retired in 1984 after 44 years with Wah Chang Corp. and its successors. The business was principally tungsten—mining, manufacturing, and trading, with occasional sidelines in export/import. Currently he does some consulting work on tungsten and technology transfer with China.

**Harry Sedgwick** included, "After Army service (Engineers—South Pacific), managed Army TC's small boat and railroad equipment procurement engineering. Jumped ship in 1956 to GE, then to Raytheon, ending up VP Engineering at Dictaphone, Bridgeport, Conn., in 1970. Hard times for office machines—retrenchment—wipe out! Bought and resurrected burned-down yacht yard in Essex, Conn. After sale in 1978, built small boat chandlery (retailer) from scratch. Sold same December 1988; now catching up on 50 years of delinquencies and missed sailing."

**Tyler Marcy,** in his biographical data, writes, "After a World War II assignment in MIT's Servomechanism Lab, and a brief period in missile and rocket development, I joined IBM in 1951, just in time for their push into computer electronics. I helped manage IBM's conversion from tube to transistor technology and its extensive expansion of technical resources. In 1974, I joined the government as assistant secretary Navy (R&D). Finally, I was with R.R. Donnelly, the country's largest commercial printer, as vice-president for computer technology." He further comments that it has been fun to make contact with classmates of MIT, and to try to do something for the Institute.

From **George Bradshaw,** "Forty years with DuPont at Grassell, N.J., Cleveland, Ohio, Wilmington, Del., Charleston, W.Va., Argentina, and LaPorte, Tex. My work included processing engineering and supervision, engineering design and construction; last assignment was staff engineer at DuPont's LaPorte plant. Member AIChE. Since retirement in 1980, have been enjoying golf, fishing, gardening, and travel. (And some consulting.)" For the last four years, George has been the director of the local (Destin, Fla.) municipal utility district. This involved complete renovation of the sewer and water systems.

**Margaret Dienes,** a high-school classmate of mine, comments, "Being an MIT graduate has been wonderful for me. I think MIT should keep up its image as a top scientific institution and forget about recruiting 'well-rounded' students, who have plenty of other places to go. In fact, I think the decline in educational standards is the second major problem in the world, after overpopulation." Peg retired January 1, 1987, after 30 years as technical editor at Brookhaven National Laboratory, Upton, N.Y., where her husband was a senior physicist. Currently, she does contract editing for Fermi National Accelerator Laboratory, Batavia, Ill. She has had trips over most of the world, and enjoys more traveling since retirement.

Next month, we shall have more quotes from the reunion book. In the meantime, send your comments and information to—**Richard E. Gladstone,** secretary, 1208 Greendale Ave., Needham, MA 02192, (617) 449-2421

# 41

Many classmates, especially those from other countries, will remember **Knut Joachim Johnsen,** who died June 6, one week after the death of his wife Gertrude. Knut was born in Gullaug, Drammen, Norway in 1917. He prepared at the Drammen-Latinskole in Norway. He studied chemical engineering and was a member of the Phi Kappa Sigma fraternity.

**Charles N. Gilligan** died June 4 in the Leahy Clinic after a long illness. Charles graduated with a BS degree in public relations, according to a clipping from the *Arlington Advocate:* "Mr. Gilligan earned numerous technical certificates in electronics and transmission. He was a 37-year employee of the New England Telephone Co. before retiring as district manager, routing, in 1981. Charlie was a founding member of the Marching and Chowder Society, committee chairman of Arlington Scout Troop 305, member of the Telephone Pioneers of America, and a member of the Arlington Touchdown Club. He was a naval chief petty officer during World War II and was awarded nine campaign ribbons, a good conduct medal, and a presidential citation. As a chief aviation machinist mate, he was the first sailor to land at Leyte Gulf. He achieved the highest score at the Ford Aviation School in Ypsilanti, Mich. He leaves his wife Geraldine (Gingras), two sons, and two daughters.

All classmates send birthday greetings to **Howard O. McMahon,** and wish him a speedy recovery.—**Joseph E. Dietzgen,** secretary, Box 790, Cotuit, MA 02635

# 42

A good newsy letter from **Art Power.** Still very active in chemical engineering consulting, principally doing process evaluations and research planning for the Solar Research Energy Institute in Golden, Colo., on fuels and chemicals from renewable resources. What with the current news from the "zanies" in the Persian Gulf, Art's efforts are doubly needed right now, if not sooner!

**Will Shaw** is working in the Huntington Beach, Calif., oil spill bird rescue program. He helps care for a collection of apes, fowl, ungulates, rabbits, and a desert tortoise, and spent 40 days skiing last season. . . . An impressive four-column article in the *Sudbury* (Mass.) *Town Crier* about **Ed Campbell**'s run for the local school committee. Ed, we hope you won. Do let us know for the next class notes.

**Al Goldis** is working on public sector contracts for a data communications company and golfing weekends in the Poconos. . . . **Mort Goulder** continues as president of M.E. Goulder Enterprises, Inc., doing consulting in venture investment capital management. . . . **Bob Greenes** still lives around the corner from me, is president of Petroconsult, Inc., working for industry groups and for individual companies, and was elected a trustee of the Village of Scarsdale. He is also active on the MIT Council for the Arts.

**Al Hayes** remains in the Mojave Desert with the cacti, coyotes, and rattlesnakes for near neighbors. He has joined the Musician's Union and plays trombone and euphonium with the Palm Springs Symphony Orchestra. . . . From Port St. Lucie, Fla., **Paul Hotte** is active in real estate and in his brokerage business. Paul also does Rotary International group exchange and scholarship programs.

**Carl Jealous** is in Youngstown, N.Y., is president of the Union Carbide Retirees Club in the Niagara area, an elder in the Presbyterian church, and has visited with Betty and **Dick Haven** in Fulton, N.Y., to continue a year-long bridge game. No report of who is ahead on the bridge score pad.

**Warne Johnson** visited with **Jim McClellan** in Harvard, Mass., and is still working as director of business development and planning at American Cyanamid in Wayne, N.J. . . . **Fran Karlan** retired from the Columbia University Dental School but continues to teach there part-time. She's probably our only classmate playing in a mandolin orchestra. (We'll see how much mail we get from our other mandolin players!)

**Ken Leghorn** returned from Russia, feels that Perostroika and Glasnost are having some good effects. This was written last spring. I wonder what he thinks about the situation now. . . . **Hank Lemaire**'s travels are really eclectic: the Oxford Netherlands seminar, Antartica, England, Russia, and western Canada. His travel agent must be a busy bee. . . . **Bernie Levere** is supervising construction (as a no-pay volunteer) for the Jewish community in Teaneck, N.J., and is president of the local Jewish National Fund. I'm a vice-chairman of JNF, and I can say that they do a fine job of building roads and other infrastructure and of looking after forests in Israel.

One very belated obit—**Charlie Stempf,** our sole Australian classmate, died in August 1988. His clever and interesting contributions to this column will be surely missed. Our sincere condolences to Nancy.

That gets us from A to L in the replies to the "Open Book Exam." More next month.—**Ken Rosett,** secretary, 191 Albemarle Rd., White Plains, NY 10605

# 43

The news this time comes exclusively from **George W. "Bill" Potts,** Leesburg, Fla., to whom I am very grateful. Bill writes: "Not much happens in retirement other than finding ways to keep one's mind active and enjoy each passing day. Hence, lack of news from sleepy Leesburg until now. We are members of the St. James Episcopal Church here, and by remarkable coincidence the assistant priest is Father Bill Seitz. Yes, the same **William C. Seitz, Jr.,** Class of '43, Course VI. Retired from his own parish church in nearby Clearmont, Bill is just as active in many ways at St. James, a very busy parish. Bill sends his regards to all in the class.

"Chic and I travel, mostly in the U.S., as we spent 32 years overseas, living in many of those places retirees tour. However, last fall we spent a pleasant vacation in Lorraine, France, looking for Chic's family roots, and found more than expected, including the church where her great-grandparents were married. Birth, death, and marriage records are really well preserved in Europe, and we already have my English/Scots roots to 1107! The computer is a great help in organizing all the data.

"Sorry to see I've missed some meat and potatoes. Never the one to leave the table early, I enclose a SASE to get the Albq Report."

In a separate note, Bill brags about his nine grandchildren and complains about the lack of an MIT Club in the Orlando area.

**Stan Proctor** urges prospective 50th reunion givers to consider contributing an asset while retaining a life income from it.—**Bob Rorschach,** secretary, 2544 S. Norfolk, Tulsa, OK 74114

# 44

**Stan Skelski** has retired as president of Shuster South in Atlanta, Ga., The firm was an international consultant to the food, drug, and cosmetic industries. He has formed Falmouth R&D Associates (FRDA), a consultant organization for the food, drug, cosmetic, softgoods, chemical specialty, and medical device industries, as well as government agencies. FRDA specializes in creative technologies, utilization of process wastes, sanitation, environmental protection, and foreign technical management consulting. Stan's new address is: 22 Old Main Rd., P.O. Box 1196, N. Falmouth, MA 02556. We welcome him to Cape Cod and look forward to his help in some of the class activities.

Not to be outdone, **Will Rodemann** has incorporated a new manufacturing company, YACHTSAVER, located in Round Pound, Maine. His goal is to improve boating safety. The product is a portable, deployable flotation device that keeps the boat afloat when holed by grounding or collision. They have been awarded a very comprehensive patent, and Will says, "For no more than the cost of a life raft we can save the boat and the crew. We wish both Stan and Will good luck in their new endeavors.

This is the month for patents. **Ken Nelson** tells us that he received a patent for a two-shot, two-color injection molding process. Tags and signs made with this process have molding indicia ten times as thick as painted products. Thus they can pack in ten times the amount of ultraviolet stabilizers, and the tags and signs are essentially abrasion and corrosion proof. Ken is looking for marketing consultants with a knowledge of markets where corrosion proof identification products are needed. At present, he is selling primarily to electric utilities and telephone companies.

We have more sad news than usual to report. **R.J. Horn** died in June of this year. He was a patent attorney with the Boston firm of Kenway, Jenney & Hildreth until it was dissolved in 1987. The most significant of the cases he worked on for MIT was the Forrester patent, regarded as a pioneer patent for the random access memory computer that launched the computer industry. Before joining the law firm, R.J. worked at MIT's Lincoln Laboratories. An Arkansas native, he (like many of us) served as a lieutenant in World War II. After graduating in 1946, he went on to receive his law degree from Boston College and also graduated from the Sloan School of Management. He held a private pilot's license and was a life member of the Musketaquid Sportsmen's Club. He also served on the Concord Conservation Commission and was active in planning a number of the class reunions. He leaves three children and a granddaughter.

**John Farley** also died in June. He was a patent attorney for 40 years with the firm of Fish & Neave in Manhattan. He received his law degree from the University of Memphis Law School. He leaves his wife, Eileen, six sons, two daughters, and three grandchildren. . . . **Robert Reilly** died in April of this year. We have no other details except that he is survived by his wife, Jane. We extend our sympathy to the survivors of these classmates.—Co-secretaries: **Andrew Corry,** P.O. Box 310, W. Hyannisport, MA 02672; **Louis Demarkles,** 77 Circuit Ave., Hyannis, MA 02601

# 45

Here are the winners from **Charlie Patterson**'s reunion award ceremony, not necessarily in order of importance. *Fred Astaire Trophy:* **Jake Freiberger** for total points, style, stamina, as well as peculiar body movement. Jake cut up quite a storm on the dance floor. *1985-1990 Continuation Trophy:* **Mat Harrington** and **Ray Pelley.** Charlie had two 40th reunion trophies and wanted to honor two old V-12 roomates. *Jacques Cousteau Marine Trophy:* **Margery Battin,** who had on an outfit that looked like she was attired for either swimming or quohog digging. *Dan Quayle Tennis Trophy:* **George Bickford** for checking out tennis during a morning downpour. *Caesar Romero Trophy (First Annual):* **George McKewen,** who has had a twinkle in his eye since 1942. George was joined at reunion by a charming young thing. *Nice Family Award:* **Nick Mumford** and Carol for 20 grandchildren. *Pat Bradley Trophy:* **Pat Standish** for a birdie on the par three fourth hole. Pat's tee shot skipped off the water on to the cartpath followed by an 8 iron into the hole. *Patty Berg Trophy:* **Julia Ing** for being the first lady on course at 14:31 Friday. *Doc Edgerton Strobe Trophy:* **Tom Markey** for being on phone with room complaints 1.6 seconds after entry. *Hill Street Blues Police Trophy:* **Nancy Hart** for directing traffic during Friday's square-dance. *Helen Keller Putting Contest:* **Jan Patterson,** who needs a personal trophy in her house—and she has been so understanding. *Jack Armstrong Trophy:* **Frank Gallagher,** not only for winning the putting contest with a range ball but also as a first class windsurfer. *James Reston Memorial Trophy:* To yours truly for long service as well as the inability to spell Paterson correctly.

**Nick Mumford** is director of stewardship at the Episcopal Diocese of Michigan. . . . **Charlie Patterson** retired from Metals and Controls, a division of Texas Instruments, six years ago at age 59. Charlie claims he is between jobs. . . . We have previously reported on **Dick Battin**'s professional activity, including current worldly presentation called, "Something Funny Happened on the Way to the Moon!" . . . Although formally retired **Tom Markey** works a couple of days a week in the snack business as a consultant to his former employer, Edlawn Flavors.

**Matthew "Red" Harrington** is now Mat, as his flaming red hair has turned gray. He retired from Shell Oil in August 1989 after 42 years of service, including 14 moves. Mat missed recall during the Korean conflict due to his weight of 250 pounds plus blood pressure at the same level. Today Mat weighs about 200, probably less than during his V-12 days. By now, Mat and Jane should have moved to Carmel, Calif. . . . Four years retired after a 40-year career with Proctor & Gamble in Cincinnati, Ohio, is **Ray Pelley.** Ray learned early on he wasn't much of an engineer, and so he pursued a management career in detergents, prescription drugs, and then back to detergents. Ray keeps up with Lulu and **Walt O'Connell,** happily retired in Tarpon Springs, Fla. . . . **Bob Gardner** is an architect in Cedar City, Utah, since 1948. The operation was a territorial monopoly when you consider that there was no other architect within 150 miles for many years. . . . **Bob Schumacher** is a Chicago-based patent attorney, and was classmate of **Jeptha Wade** at Harvard in 1950.

**Bob Schmitt** took a master's degree in mechanical engineering from Harvard to Honeywell for ten years, followed by a stint as chief engineer with Pressure Products, Inc., a manufacturer of high pressure vessels, pumps, and the like. Then he went to Yarway Corp. as manager of applied engineering for ten years, and finally he got a piece of the action at a spinoff of Pressure Products. He retired in 1988 but continues as a professional engineer in Pennsylvania and New Jersey, with much time in Hancock, N.H., during spring, summer, and fall. . . . This was **Bob Bronson**'s first reunion. He was at Texas Instruments in Dallas for 18 years, and then 18 years in California as corporate vice-president at SFE Technology, a manufacturer of capacitors, conductors, and the like. His ten children are, we believe, the class record for the same couple. Wife Helen was a Navy nurse Bob met at Treasure Island while recovering from a broken leg in early 1946—tough Navy duty as the leg was broken while skiing. . . . **Hart Kircher** spent 23 years with Reaction Motors, a rocket engine manufacturer in Sparta, N.J., before joining Grumman Aerospace in Bethpage, N.Y., in 1969. Although Kirch had a room out on Long Island he says that he—all too often—commuted daily from Sparta; it was only a 170-mile round trip.

We helped Barbara and **George "Curly" Bickford** celebrate their first anniversary on June 10. Although George retired from Carrier Corp. six years ago, he continues to consult for them. George and Barbara are avid skiers, golfers, and tennis buffs. Barbara's 11-acre farm has a new tractor, which George has named Barbara's Mink.

After all too many years in Connecticut, Betsy and **Tom Hewson** moved to Merritt Island, Fla., in October. Merritt is a 200-yard by 10-mile island on the Inland Waterway located at the junction of the Indian and Banana Rivers. For one who had five bypasses about three years ago, Tom is in great shape; he claims to be 29 clad in 65-year armour. . . . **Sherry Ing** continues as chairman of the board at Aloha Airlines; during idle moments he develops condos and exports macadamia nuts. . . . **Frank Donohue** finally retired January 1 and has now turned his full attention to golf. . . . **George McKewan** claims three wives and ten children, but upon reflection reports that only two children belong to him. George continues active

as chairman and president of International Metals and Machine, a $200 million annual sales operation in Des Plaines, Ill. . . . Since his Pfiser, Inc., retirement, **Peter Agoston** keeps busy as a volunteer at White Plains (N.Y.) Hospital. He raves about MIT Century Club tour he and Eva took to the Galapagos Islands about a year ago. . . . Some time between our 25th and 45th reunions, **Bob Gould** abandoned engineering for the automotive industry—not manufacturing, but selling, leasing new as well as owner-owned (not "second-hand") vehicles. Bob lost his wife Ruth in 1984 but found Alice in 1986. . . . **George Berman** is a newlywed who has abandoned all activity at his old Unitrobe Corp., but is itching to start something new. . . . **Allan W. Jayne** divides his time between Gabriel Labs in Needham, Mass., and Honolulu. . . . **Jim Levitan** received his LLB from Columbia, where he was a Kent Scholar, Stone Scholar, and editor of the *Law Review.* From 1951 to 1965, Jim was an associate at Debevoise, Plimpton in New York City. Since 1965 he has been a tax partner and department head at Skaddaw, Arps, Slote, Meagher & Flom. . . . **Emily V. Wade** serves as vice-chairman of Manomet Bird Observatory, which carries on considerable basic research in the environment. She is also active with MITS, a group of eleven organizations committed to improve elementary science teaching through teacher research.—**Clinton H. Springer,** secretary, P.O. Box 288, New Castle, NH 03854

# 46

I don't know how he does it, but **Don Burke,** old XVI mate, found time to post his informative letter the end of July, telling of his and Pat's plan to visit the troubled Middle East (United Arab Emirates and Yemen) in the Fall. Beyond this intrepid adventure, Don and Pat scheduled some black tie and tux events in the "Apple" at the Met and Carnegie Hall. Along the way, they hope to drop in on **Bob Striker** and wife Pat, who live in Port Washington, where Bob (at last note) was president of Beaveronics Industries. He has some great "tales to tell about powering up the radio and TV studios in New York as the network moguls used their own power plays to build their media empires."

Don also mentions St. Pete (Fla.) closest friend and XVI classmate, **Don Robinson,** who is retiring from his photo marketing family business, allowing more time to spend with his children and grandchildren in various parts of the country. The Burkes enjoyed camping with the Robinsons over the years and honor our/my favorite dictum, "Take only pictures; leave only footprints." In whatever quiet moments Don (Burke) has, he is embarking on a "simple morality/immortality play, "Grandma, Johnny, and the Everlasting Apple Tree" to promote his "Institute of Understanding" (IOU), which is currently "on hold." It sounds like a convoluted project to say the least.

My other report, arriving here via the Alumni/ae Association, has inexplicably disappeared, much to my regret—and apology, to **Ed Potter.** I remember reading about his living in Westport, Conn., with wife Marjorie, and their commitment to country dancing. Ed and Marjorie work professionaly in all kinds of country dancing, from American squares to English dancing. Last I heard, Ed was manager of integrated logistics support for a branch of UTC in Norwalk. Additional interests include singing in the church choir, camping, and kayaking. The Potters have four children and four grandchildren.

Have a joyful holiday season!—**Jim Ray,** secretary, 2520 S. Ivanhoe Pl., Denver, CO 80222

# 47

**Tom Bay** lives in Los Gatos, Calif. He recently broke his wrist playing tennis. . . . **Bart Carmody** moved to Florida last year, where he is a management consultant with Procurement Specialists, Inc., in industrial and construction procurement. . . . **Steve Dieckmann** lives in Wilmington, Del. He and his wife may join the mini-reunion with the classes of '48 and '49 at Martha's Vineyard in September 1991. . . . **Carl Eyman** retired last year and now lives in Thibodaux, La., spending his time restoring an old oyster boat.

The *New York Times* reports that **Willis Reals** retired in August as corporate vice-president of Texaco in Houston. He was also chairman and president of Texaco Chemical Co., a subsidiary of Texaco. . . . **Hrand Saxenian** reports that he is back at MIT teaching an undergraduate seminar in leadership and teamwork. His daughter, Anna Lee, received her PhD from Tech last year in political science. . . . **Walter Weeks** and his wife took a camera safari to Kenya in September 1989 and had a great time. . . . **Leonard Winship** works with TV Productions in Fairfax, Va., on the custom design of special purpose electronic equipment. Perhaps more important: he has seven grandchildren.

That cleans out our files. Send news.—**Robert E. McBride,** secretary, 1511 E. Northcrest Dr., Highlands Ranch, CO 80126

# 48

**Dan Fink** continues consulting and serving on the board of directors of several companies. Recently, Vice-president Quayle announced that Dan was one of 11 individuals appointed to serve on the Advisory Committee on the Future of the U.S. Space Program. The Advisory Committee will advise the NASA administrator on overall approaches NASA can use to implement the U.S. Space Program for the coming decades. The committee will have a broad charter and will report its findings within approximately four months. It will operate as an independent entity, and will submit its findings to the Administrator of NASA, and with him to the Vice President in his capacity as Chairman of the National Space Council.

**Harold Ottobrini** started making plans for our reunion in September 1991 with the classes of 1947 and 1949. Harold and Eleanor will visit the Harborview Hotel on Martha's Vineyard in September to evaluate the indoor and outdoor facilities. Also, they will begin plans for our Saturday night banquet.

**Peter Guercio** has been vice-president and general manager of AMETEK's multiplant Specialty Metal Products Division for two years. Peter had served as general manager of the metal powder business when Pfizer, Inc., owned the operations and had held various management positions in his 38 years with Pfizer. Then when AMETEK purchased the division from Pfizer in 1988, Peter was made a vice-president. Recently, AMETEK created the post of group vice-president of the corporation to which Peter was appointed. In his new position, Peter will be responsible for the operations of the company's five industrial materials divisions, which have eight plants and produced about $175 million in sales last year. Peter was credited with managing two plant expansions and near-doubling of sales since January 1988. Peter and his wife, Jane, live in Scarsdale, N.Y.

**Harvey Taylor** retired after 25 years at Hughes Aircraft, where he held a series of engineering management positions. He has moved to the hills of Tarzana, Calif. His slide rule sits framed on the wall of his study as an interesting historic relic. . . .**Anton Hansmann** retired from the U.S. Navy. He is active as a Coast Guard auxiliary pilot making pollution and safety patrols on Potomac and Chesapeake Bays. Much help is needed, but he is working to maintain an airstrip on Pitcairn Island. . . . **Robert Klausmeier** of Wilmington, Del., is retired and enjoying it. He also is still enjoying his MIT education. . . . **Al Baum** is working for OSHA, trying to ensure a safe and healthful workplace. . . . **Erik Mollo-Christensen** is associate director of Earth Science and NASA/Goddard Space Flight Center in Greenbelt, Md.

**Harry Jones** continues his high technology merger and acquisition activities. One major change in his personal life is that his son, Craig, who lived at home for four years after college, has bought his own condo and moved out. Harry and his wife, Ann, are finding this to be like a second honeymoon. . . . **George Clifford** has accepted the Alumni/ae Association's request to be chairperson of the committee to plan Technology Day in 1991. In addition, George is moderating a panel presentation during a workshop at MIT. The workshop is for class presidents to share ideas on class organization and planning, class publicity, reunion activity, and class giving.

**Ben Ball** is president of a consulting firm involved in energy issues, following a long career with Gulf Oil, from which he retired as vice-president. Ben also serves as director of MIT's Integrated Energy Systems Project. Recently Ben joined two faculty members in writing a book, *Energy Aftermath* subtitled *How We Can Learn From the Blunders of the Past to Create a Hopeful Energy Future,* published by the Harvard Business School Press. The book was written before the Iraqi invasion of Kuwait. It will interesting to see how many of the blunders of the 1970s will be repeated in 1990. The authors suggest that all sectors of society contributed to the blunders in the energy industry: academics and scientists oversold their ability to analyze and forecast; business leaders searched for simplistic solutions; policymakers preferred high-sounding slogans to studying and understanding the complexities of the issue; and technology proponents chose to push their causes with little reference to economic and market realities. The authors maintain we can learn from mistakes of past. *Energy Aftermath* is not about greed or duplicity; it contains no villians. The book is about the flawed decision-making process in large technical systems, about human lapses in judgment and how they can be avoided.

**Martin Starr** who is affliated with the Graduate School of Business at Columbia University, wrote a chapter in a recent book, *The Quality and Productivity Equation,* about American corporate strategies for the 1990s. Martin's chapter was "How 'Fast Response Organizations' Achieve Global Competitiveness."—**Marty Billett,** secretary and president, 16 Greenwood Ave., Barrington, RI 02806, (401) 245-8963

# 49

**Jim Veras** writes that he was honored in April by appointment to the position of senior vice-president of the World Environment Center in New York City. The WEC teaches governments, multinational corporations, and the employees of those corporations how to exist on this planet without killing it. This service is supported by the U.S. Agency for International Development, the U.S. Environmental Protection Agency, the World Bank, the U.S. Trade Development Program, and corporations like IBM, AT&T, Kodak, GE, GM, 3M, and Westinghouse, many of which Jim persuaded to join the International Environment Forum—a part of the WEC which facilitates environmental communication among the 56 members. Problems tackled by the WEC include the nightmareish pollution in some eastern bloc countries, such as Poland. Jim writes, "In May, I accepted an offer by the board of directors of the World Environment Center to become a full-time employee rather than its consultant. In July, I turned 65; it's fair to say I'd rather be addressed as *senior* vice-president than *senior* citizen. I spent eight wonderful years as a consultant after 33 years in industry (Ford Motor Co., Hoover International, Amerada Hess Corp., and W.R. Grace & Co.), and I'm absolutely excited by and dedicated to my new career. What better way to use life's experience and to help in a critical arena—our precious environment, globally? While a consultant, I devoted a great deal of time to MIT

alumni activities and enjoyed it immensely—great to give something back to a great institution of which I am privileged to be an alumnus. Grandson and namesake Dimitri (11 1/2) shows a strong inclination to mathematics and computers—could be MIT Class of 2001, a grandfather's dream. In retrospect, I've been extremely fortunate to have had the best immigrant parents, education, wife, children, career, and survival in World War II as a combat infantryman."

After **Dave Gaillard**'s death I spoke with his wife Barbara, who told me she was deeply moved by the eulogy given by **Jack Lovedahl.** It tells more about Dave than any standard obituary could ever do: "This will be the most rambling eulogy ever heard. How could I sum up in five minutes the character of a man with whom I never talked in a serious, non-bantering tone in the 48 years that he's been my best friend. I always took for granted that he was just *there.* Only in the last three days have I tried to comprehend his uniqueness. We were freshman roommates at the Chi Phi fraternity. What I learned then was that he already knew *exactly* what he wanted to do with the rest of his life: *to have fun doing the same things forever.* By age 17 he knew that sailing, jazz, and golf would be lifetime pleasures; by age 19 his greatest pleasure, Babs, had been found. He never lost enthusiasm for any of them, though later he substituted skiing for his college wrestling career. His happy-go-lucky, exuberant personality hid a core of great talent. He was probably the most brilliant man I ever knew, and got straight A's at MIT for an entire year. I might add, this didn't occur during his two years as *my* roommate, but afterward when he was married to Babs. He was an extraordinary athlete. During his freshman year at MIT, he received the highest award available to a varsity athlete (the Straight T), an unprecedented accomplishment for a freshman. Few others received it; all were upperclassmen. He was a superb sailor, with very rapid reactions. He never lost his touch. The David duBose Gaillard II Trophy will be a perpetual award at the Star Class Championship of the Chesapeake Bay, which Dave ran for about 30 years at Gibson Island. I suggest it be given to the boat which is fastest to the first windward mark. Good bye, old buddy."—**Fletcher Eaton,** secretary, 42 Perry Dr., Needham, MA 02192, (617) 449-1614

# 50

This is the first opportunity I've had to report on the excellent 40th reunion held last June for the class of 1950. Many thanks are due to the committee, under the able leadership of **Hank Sharp,** that worked to present such an outstanding reunion gift to MIT ($4,615,239). Out of this total, $1,023,894 has been designated for the Class of 1950 Scholarship Fund. Congratulations are due to members of the class who made donations. Over 65 percent have contributed, but if you are not in that statistic, there is still time to make a contribution.

Those who attended the reunion in Cambridge and on Cape Cod report that it was terrific to renew acquaintances after 40 years. A brief review of the attendees indicated that about one-third were at their 1st reunion, another one-third attended at least three of our class reunions, and the remainder had missed either one or had attended every reunion since graduation. About 250 classmates and their companions attended at least part of the five-day affair. From all reports, everyone had a great time because of the arrangements; attendees were able to focus on those portions of the reunion that best suited their time and interests. Many thanks to the committee who spent long hours preparing for this once-in-a-lifetime event.

As part of the reunion, a questionnaire was sent to all known classmates so they could exchange with others a little about themselves. This resulted in a 1950 class book that was distributed to all attendees. The committee is now making a copy available to everyone who would like one. We have an adequate supply at this time, and you can request a copy of the *1950 Class Book Statistics and Personal Inventories* from the MIT Alumni/ae Association, Building 10, 77 Massachusetts Ave., Cambridge, MA 02139, Attention, Ms. Eliza Dame.

Other class news at this time. . . . **James Goff** retired from the Research Technology Department, Naval Surface Warfare Center at the end of June 1990. He is the national treasurer of Ancomunn Gaidhealach (Gaelic Language Society) and is learning to play the bagpipe. . . . **August Doering** is retiring this year from S.D. Warren (Scott Paper), and he is planning to do a lot of sailing in his Bristol 35. His first trip will be to Prince Edward Island from his home in Windham, Me. . . . **Sam Raymond** is still located in North Falmouth, Mass., and is still with the company he founded in 1962. He is now chairman and chief scientist for Benthos, Inc. The company chiefly makes underwater gadgets for scientists and navies. . . . **A. Craig Hood,** a fellow of the ASM (American Society of Metals) was recently named Delaware Valley "Metals Man for the Year." He is president of Ach Technologies, Inc., of Wayne, Pa. The company advises clients on all phases of mechanical fastening from product design and manufacturing to final applications.

Keep the news coming.—**John T. McKenna,** secretary, P.O. Box 376, Cummaquid, MA 02637

# 51

Our reunion arrangements are proceeding well. The sizable committee chaired by **Harold Glenzel** has been meeting and working hard to make certain that this will be a memorable event. Renewing old friendships, the nostalgia of being back at Tech, and enjoyment of events at Tech and on the Cape present an irresistible combination. We will have only one 40th reunion, so make sure you are a part of it.

Our gift cochairs, **Bill Maini** and **Marv Grossman,** are encouraged by your response to the appeal for our Class of 1951 Fund for Excellence in Education. This portion of our class gift will support innovative projects that enhance teaching excellence at MIT by recognizing those who are models of what quality educators should be like. You can support this special portion of our class gift by designating the Class of 1951 Fund for Excellence in Education when you make your contribution or pledge. All your pledges for the past five years and the next five years can be credited to our 40th reunion gift.

Some time ago, you should have received the form for your page in our reunion book. If you returned the completed form and photographs, your place in history is assured. It is already past the deadline, but our reunion chair, **Harold Glenzel,** tells me that he may be able to sneak in a few stragglers if he gets the forms within the next several days. If you are among the few that have not returned the form, please do so today. We want our complete class represented.

Having designed and developed aluminum buildings that are in use in 25 countries from Soviet Armenia to Diego Garcia, **Donald Brown** is retiring. He and his wife will spend their golden years in North Captiva Island, Fla., and Cape Rosier, Maine. Don plans to see us at the reunion next year. . . . Upon retiring from the faculty of his alma mater, Phillips Exeter Academy, **C. Arthur Compton** received their outstanding faculty award. Arthur was part of their faculty since 1955, following his graduate work at Harvard, as a member of the science department and as Independence Foundation Professor. . . . Retiring after 38 years of work, the last 25 with Boeing Aircraft in the development of rotary wing aircraft, **Charles W. Ellis** writes about his final assignment: He was vice-president in charge of a new tilt rotor aircraft development. This aircraft takes off and lands like a helicopter and cruises like a high speed turboprop. He sees a lot of potential for this product in both civil and military applications.

Selected to present the prestigious Campbell Memorial Lecture by the ASM during Materials Week in October in Detroit, **Merton C. Flemings** chose the topic "Metal Alloys in the Semisolid State," discussing alloys that can be formed through rigorous convection and slow cooling that possess properties greatly different in the semisolid state than those of dendritic alloys. He has been at MIT since 1956 and was appointed professor in 1969. He initiated and was first director of MIT's Materials Processing Center in 1979. In 1981, he was appointed Toyota Professor of Materials Processing and in 1982 became department head. . . . In July 1990, the most prestigious award of the National Society of Professional Engineers will be presented to **Herbert H. Woodson,** dean of the College of Engineering at the University of Texas in Austin. He was recruited to become chairman of their electrical engineering department in 1971. He created and directed their Center for Energy Studies and cofounded their Center for Electromechanics. Over 33 years at the University, his primary focus has been on applied magnetics, electromagnetics, and electromechanics. He coauthored "Electromechanical Energy Conversion," a book widely credited with changing how electrical engineers are taught about rotating machinery.

Sadly, I have to bring you word of the loss of three classmates: Born in Hamburg and receiving his early education there, **Jurgen Elkan** fled from the Nazis in 1933. Making his way through Antwerp, he entered the United States in 1941 after 18 months in an internment camp in occupied France. He entered MIT after enlisting and serving as a first lieutenant in military intelligence during World War II. Receiving bachelor's and master's degrees at MIT, he worked for Lincoln Laboratory, Hermes Electronics, and GTE. We express our condolences to his wife Gretel, their daughter Judy, and others of his family. . . . Prior to entering MIT, **Richard Fidler** earned a degree from Gettysburg College in Pennsylvania. He entered MIT after his naval service during World War II. He received a master's degree from MIT in 1967. He worked at the GTE Strategic Systems Division and retired from there after 30 years of service. He was a member of the board of Old Sturbridge Village and former president of the National Security Industrial Association. Our sympathies are extended to his wife Katharine, his mother, his four children, and his eight grandchildren. . . . Born in Holyoke, Mass., **Robert J. Greaney** received a degree from Amherst College as well as MIT. He lived in Rockville, Md. We wish to express our condolences to his wife Dorothy, his two sons, and his daughter.—**Martin N. Greenfield,** secretary, 25 Darrell Dr., Randolph, MA 02368

# 52

He does not expect it to become a best seller, but **John Fitch** is pleased to have finished his book, *English Ancestors of the Fitches of Colonial Connecticut,* to have been published by Picton Press last summer. Now he is beginning Volume 2, covering his immigrant ancestor, who arrived in 1638, and continuing to his grandfather, a missionary to China. John's writing has provided the occasion for a lot of travel. At the time he wrote to me, he was anticipating a trip to England with a Connecticut historical group, with side trips to Paris and to Germany to visit his son Bob, '73, and his German wife.

John has done his bit toward providing for future Fitch genealogies by raising six children—four boys and two girls. Four children are married, but genealogical progress is currently stalled at one grandson. John and his wife, Mary, are both retired and live in Cambridge.

John courteously ended his letter to me with

pleasant reminiscences of Palo Alto, where **Allan Chin** also lives. Allan says that a few days after attending the MIT Founders Reception in Silicon Valley last spring, he was "bought out" by his company. He is now semi-retired, with a couple of consulting contracts that keep him busy half-time.

I think **Emil Volcheck** is busy full-time. After 34 years in R&D in synthetic fibers, including the last 12 as research manager of the Pioneering Research Division of Du Pont's Fibers Department, he retired last December to his home in southeast Pennsylvania to pursue hobbies in astronomy and computers and to raise his youngest child, age 5, just entering elementary school. He expects it to be a challenge for quite a few more years.

**Bruce Curry** of Wayne, N.J., writes that since 1984 he has been director in charge of the Computer Resources Department at KPMG, which sounds like a radio station, but is, I believe, an accounting firm.

NASA awarded **John C. Wilson** its Exceptional Service Medal last June. John has worked at the U.S. Army's Aerostructures Directorate at the Langley Research Center since 1970 and is currently head of the Rotorcraft Aerodynamics Group. He and his wife live in Newport News, and they have two sons and a daughter.

I am very sorry to report the deaths of two classmates. **Sergio F. Valdes,** a member of the technical staff at Aerospace Corp., died November 24, 1989. I have no more information about him. . . . **J. Arthur Taché** of St. Clair, Mich., died of cancer August 20, 1989. He had retired the previous January after 37 years at Chrysler Corp. as a metallurgical supervisor. He is survived by his wife, Norma, five married children—four sons and a daughter—and nine grandchildren. His wife writes, "Arthur enjoyed his family. He frequently hunted and fished with his boys and his grandsons. He enjoyed life to the fullest, not letting his brief illness be a hindrance, and left many fond memories to those surviving."
—**Richard F. Lacey,** secretary, 2340 Cowper St., Palo Alto, CA 94301

# 53

**Colin Ware** reports that he is currently trying to extend a project he began a number of years ago. It has been partially completed, and disclosure became the basis for the Discover Card system. He is currently seeking development funding to proceed with further development of the credit/debit card system. He is also looking for additional ideas.

**Marty Wohl** reports that **Bill Gouse,** senior vice-president of MITRE, has been appointed our class agent. Also, Marty says he saw **Bruce Murry** on the McNeil Lehrer report talking about the problems of the Hubble Telescope.



*Janet and Mort Grosser*

I received a long letter from **Janet** and **Mort Grosser.** They are continuing their escapades in Menlo Park, Calif. A year or so ago Mort did a report on the human-powered aircraft. Now Dover is putting out a paperback edition of his book, *The Gossamer Odyssey,* which reports on that earlier effort. He has also recently published his seventh book (expected out in October 1990), *The Fabulous Fifty,* a novel about the 1921 World Series, the first subway series.

Writing is a hobby for Mort. His major job is in the management and technology consulting field. He concentrates on start-up high-tech companies in and around Silicon Valley but also does some work on strategy at the top level of large companies such as Du Pont and Hewlett Packard. Mort also consults and teaches in Chile and spends time on the MAP (microelectronic axon processor) nerve chip research project that he cofounded at the VA Hospital and Stanford Medical School. The project is moving ahead and spinning off papers, patents, and dissertations.

Janet is running her graphic design and calligraphy business but is spending most of her effort on the San Francisco Ballet. She was recently selected president of the San Francisco Ballet Auxiliary. She will soon publish a book of her own (September '90) that illustrates what to look for in a classical ballet performance.

Janet and Mort's son, Adam, received his MBA from Stanford and will soon start as managing director of Entertainment Systems for Lucasfilm. He previously worked at Apple as a senior product designer and won many national and international prizes for designing the Apple IIGS, the MAC II, the Knowledge Navigator, and others.

I hope some of the rest of you will write so I can share with our classmates news about their long lost friends from the "old days." Keep the news coming; otherwise I'll have to tell you about my week at the Delaware shore last August.—**Gil Gardner,** secretary, 1200 Trinity Dr., Alexandria, VA 22314, (703) 461-0331

# 54

A note from **Bob Warshawer,** our permanent reunion chairman, informs us that all accounts have been settled for our 35th reunion last year, and we have a healthy bank balance to get us started on the big 40th in 1994. Plans are already being drawn up—we will keep you informed of progress.

**Dan Farkas** writes that he has left his position as vice-president of Process Research and Development at Campbell Soup Co. to become head of the Department of Food Science and Technology at Oregon State University. You may recall that Dan held a similar position at the University of Delaware before joining Campbell Soup. The move to Oregon was a return to her home area for Dan's wife, Bridget. . . . Word comes from **Paul Stern** that he is now executive vice-president for The Ratkovch Co., a Los Angeles based developer of urban mixed use projects. He and his company are currently working on a 3-million-square foot development in downtown Long Beach and another large project that includes a craft art museum, retail and office space, and 60 residential condominiums. . . . From a newspaper report, we learn that **Bill Zoino,** president and CEO of GZA GeoEnvironmental Technologies, Inc., of Newton, Mass., has been appointed a director of People's Savings Bank of Brockton.

We are very sorry to have to report the death, last June, of **David Dennen.** Dave was vice-president of operations for Biogen, Inc., of Cambridge, Mass. He had formerly served as vice-president of Eli Lilly and Co. in Indianapolis, where he had been employed for 35 years. Our sincere sympathy goes to his wife, Jane, and their two daughters.—**Edwin G. Eigel, Jr.,** secretary, 33 Pepperbush Ln., Fairfield, CT 06430

# 55

More news from our 35th reunion. After the formal end of the reunion at the Cape, a small group journeyed to Bermuda for an extension of our good time together. Jan and **Ed Ehrlich,** Nancy and **Duwayne Peterson,** Polly and **Paul Attridge,** Trudy and **Elmer Crouthers,** Edie and **Bob Greene,** and Georgia and **Jim Eacker** enjoyed four delightful days at the Sonesta Beach Hotel. Several of us had honeymooned in Bermuda way back when and were pleased to see how little the islands have changed since then.

Of 183 respondents to the class reunion questionnaire, 101 are suburbanites, 28 live in large cities, 30 in small cities, 19 in rural areas, and 3 "other." One hundred four have master's degrees (52 of those from MIT), and 57 have doctorates (19 of them from MIT). One hundred three of us admitted that we drink, but otherwise seem to be a fairly health conscious bunch; 112 report that they exercise daily or a few times a week, and 57 say they exercise occasionally. Fifty-one say that their weight has stayed the same or gone down since graduation; 75 report a gain of 5-15 percent, and 53 admit to adding on more than 15 percent. Thirty-five have had a major accident or illness in the last 30 years, and 147 say they have not been so afflicted. Overall, 166 rate their health as good, and 15 as "so-so."

One hundred and fifty-eight are employed full-time and 5 part-time, 11 are retired, and 7 are not employed but looking. We claim 32 presidents, 26 vice-presidents, 16 directors, 18 professors, 13 engineers, and 1 "bum." Ninety-three work for industry, 10 for the government, 23 for a university, 45 are self-employed, and 5 work somewhere else. Seventy-three report annual incomes of $50,000-100,000, 70 claim to earn $100,000-500,000 and 7 say they have incomes in excess of $500,000 per year. (Our 40th reunion gift committee would like to hear from all 7 of you!)

The maximum number of children reported was 9, and on average we have 2.81 children, with the youngest ranging in age from 6 months to 39 years of age. At the reunion, **Ralph Wanger** took the award for the youngest child—he and Leah are enjoying a second family. On average, we have .9 grandchildren, with the largest number being 8. No great grandchildren were reported.

**Fred Lupton** had hoped to make the reunion but had to stay close by Vanderbilt Medical Center where he has been awaiting a heart transplant since last November. His wife, Jane, reports that Fred had a successful transplant on July 12 and that he is doing well. By the time you read this, Fred should be back home at 2562 Crestwood Dr., Chattanooga, TN 37415, (615) 266-1329.

**Roger Mackay** was at the wedding of a close family friend during the reunion, but he joined us for brunch on Sunday. We regret to report that Roger's wife, Alice, died of cancer in June 1988. Roger recently sold their home in Westwood, Mass., and has taken up residence at their vacation/ski home near Franconia, N.H. It sounds like that gives him good opportunities to visit with his two children, ages 24 and 26. Roger left The Carlson Group, where he had been a senior vice-president in 1986 after the company encountered problems while working in Saudi Arabia, and joined Condyne Engineering and Construction. He left there in September 1989 and now is consulting and considering what he would like to do next. Roger's new address is Box 836, Lincoln, NH 03251, (603) 745-3373.

Edie and **Bob Greene** finally sold their house in Sherborn, Mass. They had taken up residence at 100 Memorial Dr. in Cambridge some time ago and now are looking at properties on Cape Cod.

After receiving an ScD in June 1962, **Dick Schwind** and his wife, Janet, moved to California and designed and built (themselves) the house that they still are in. Dick spent seven years at Lockheed Palo Alto Research Labs, 14 at Nielsen Research and Engineering, and for the past seven years has been an advisory engineer at Westinghouse in Sunnyvale. A couple of years ago, he (along with two coauthors) won the Melville Award for the best ASME paper of the year. Since Dick does R&D in missile launchers and other defense oriented areas, he suspects a career

change could be imminent—any suggestions would be welcome. Dick and Janet have two children—Kirsten, 16, and Kelsey, 17, who is a freshman at UC/Santa Cruz. Kirsten spent the summer in Paraguay giving inoculations as a member of the Amigos program. Since the Schwinds did not make it to the reunion, they urge friends to contact and visit them. Their address is 11825 Skyline Blvd., Los Gatos, CA 95030, (408) 867-9422. Visitors are urged to bring water since the earthquake left them with a rapidly receding groundwater level.

After nearly 20 years managing various municipal utility operations, **David Peterson** started Arrowhead Management Services, Inc., in the Minneapolis/St. Paul area to assist small utility organizations in computerizing their records. He and Craig Finseth, '80, developed hardware that provides a video image of a drawing as a background image on a monitor while allowing a CAD program to trace over it. The utilities have not responded as well as David had hoped, but he has built a clientele by combining the ability to capture floor plans with a service to manage plant engineering. If you are traveling in the twin cities area, give David a call at (612) 593-0520.

With the reunion now well behind us and just a fond memory, do not forget your struggling new co-secretaries who are committed to equaling the great job done by our predecessors. Keep us supplied with your news.—**Roy M. Salzman,** 481 Curve St., Carlisle, MA 01741; **James H. Eacker,** 3619 Folly Quarter Rd., Ellicott City, MD 21043

# 56

Mrs. **Charles W. Gulotta** was appointed to the Westield United Fund Board of Trustees last May. She previously served on their Budget Review Committee. . . . **Gerald L. Kanter** is now executive vice-president for merchandising, Ames Department Stores, Inc., out of West Hartford, Conn. Previously he has acted as a consultant for various companies and was president and chief operating officer for Marshall's, Inc., out of Harrison, N.Y. . . . As a follow-up to the last report on **Ted de Winter,** candidate for U.S. Senate, the *Concord Monitor* reports that Ted is putting his best foot forward to gain voter recognition; he will walk from Greenville to Pittsburgh, N.H., and back.—Co-secretaries: **George H. Brattin,** 39 Bartlet St., Andover, MA 01810, (508) 470-2730; **Irwin Gross,** Sweets McGraw-Hill, 1221 Ave. of the Americas, New York, NY 10020, (212) 512-3181

# 57

Please send news for this column to: **John Christian,** secretary, 23 Fredana Rd., Waban, MA 02168

# 58

. . .Tis the season and once again we bring glad tidings of our far flung classmates. From Europe, **Richard Murdock** writes, "I'm now located in Holland working for General Electric Plastics. Eventually, we'll move to Spain to assist in building a new GE Plastics plant in Cartagena. Might see some alums in 1992 at the Seville Worlds Fair or the Barcelona Olympics."

And from California, **Steve Devoto** sends us a brief note: "I recently took early retirement from the Magnet Fusion Program at Lawrence Livermore Laboratory to devote more time to wine grape growing in Lake County. I sell grapes to Kendall-Jackson, Guenoc and Fetzer. Some years are like rolling dice, but at least it gets me out of stuffy offices!". . . . Down Mexico Way, **Ray Danon** has been elected a member of The Conference Board's Executive Council. Ray is managing director, Administrative Industrias Reliance. . . . **Mal Johnson** notes, "I continue to be gainfully employed as chairman of Foamseal, Inc., and hope to see both of my older sons graduate from college this year. We recently enjoyed a visit with **Ed Sullivan** and his wife, Kathy. Ed has retired from Bethlehem."

Switching to our Washington, D.C., desk, we have an update from **Bob Jordan:** "Our law firm of Steptoe & Johnson now has 200-plus attorneys and an international office in Moscow. Although I am serving as chairman and managing partner for the firm, I maintain an active law practice with heavy emphasis on litigation in Alaska, where I have been working with clients for almost 20 years. Karen and I are sending our son, Bob, off to Harvard in the fall. If any classmates are visiting Washington, please give me a call so we can have a drink or perhaps meet at the airport."

**Charles Robbins** has joined his father, Howard, in operating a trout farm in Wareham, Mass. Charles says that his father began raising stock for fresh water ponds about 50 years ago, long before aquaculture became fashionable. Now, with fish consumption rising and available stocks declining, Charles believes a market for restaurants and supermarkets can be developed as well.

That wraps up our news for 1990. Nancy and I wish you all a Merry Christmas.—**Mike Brose,** secretary, 841 Magdeline Dr., Madison, WI 53704

# 59

Please send news for this column to: **Allan S. Bufferd,** secretary, Office of the Treasurer, MIT, 238 Main St., Suite 200, Cambridge, MA 02142

# 60

I chatted with **David Staelin** during our class visit to the Cape for our 30th reunion. David was recently appointed assistant director of Lincoln Laboratory. Dave has been a member of MIT's electrical engineering faculty since 1965 and a professor since 1976. He and his wife live in Wellesley, and they have two sons and a daughter, all in college. . . . With the appointment of **Robert White** as the first under secretary of commerce for technology, our class has another member in the policymaking sphere of the Bush Administration. Bob will be responsible for the new Technology Administration that includes the National Institute of Standards and Technology (formerly the Bureau of Standards), the Office of Technology Policy, and the National Technical Information Service.

Some news on classmates comes from the press: **Richard Cahaly** recently left Polaroid Corp. to accept a position as vice-president at Goldberg-Zoino Associates, Inc., in Newton, Mass. . . . The *New York Times* reports that **Harold Parmelee** has been named president of the Turner Corp. Harold will continue as president and chief executive officer of Turner Construction Co. . . . From the *Boston Globe* comes word that **Kenneth Reinschmidt** has taken on the additional duties of senior vice-president at Stone & Webster Engineering Corp., while remaining president of Stone & Webster's advanced development services division. . . . The *Wall Street Journal* reports the resignation of **Warren Van Genderen** as President of the Patten Corp. in Stamford, Vt. . . . **Howard Rosenthal** spent the past academic year as an MIT visiting professor of economics. Howard has returned to Carnegie-Mellon University, where he has been a faculty member since 1966.

I received an interesting letter from **Kern Kenyon,** who lives in Del Mar, Calif. Kern was in Course XII, but since getting a PhD from Scripps Institution of Oceanography in 1966, he has done his research in that discipline. Kern says that he has discovered a new explanation for the lift force on an airplane wing, which ahs been published in *Physics Essays* under the title "Lift Theory for Level Flight Using Bernoulli's Principle and Cross Stream Acceleration." Kern is waiting for someone to test his theory.—**Frank A. Tapparo,** secretary, and class agent, 15 S. Montague St., Arlington, VA 22204

# 61

The yearly missive from **Bob Pease** arrived the other day. It was thick. Here are the high points. Bob is now a regular contributor to *Electronic Design* magazine. The column is about linear and analogue circuits, and it shows up twice a month. A sample column commented on the type of wire you can use in hooking up stereo speakers. He contended that no one could tell the difference between spliced and intact wire. Bob also has been writing in *EDN* magazine commenting on letters written by readers. He seems to be a sort of Anne Landers (or Miss Manners) of electrical engineering. One question: "So Bob, what do you think about spreadsheets [for linear circuit design]"? Bob's answer was direct—he "hates, despises, and detests" them. The articles have a fine, if hairy, drawing showing Bob at his intellectual best. Very nice, Bob, and good luck meeting your deadlines.

**Millard Firebaugh** is our first class admiral—rear admiral since March 1989. Congratulations! He writes that his son, Joshua, is a junior at Rice; his daughter, Samara, is a senior at a local high school of science and technology; and his wife, Barbara, teaches the hearing impaired. . . . **Sandy Wagner** writes: "After three years at IBM's General Products Division as a writer, teacher, and DASD modeler, I have joined IBM Educational Systems, which develops and markets hardward and software for use in schools. Fortunately, this is the "new IBM," and I could avoid the move to HQ in Atlanta. Reasons for staying in California are my daughter, Alice, a sophomore at UC/Santa Clara; my son, Mark, a freshman in high school; and my wife of 23 years, Linda, a science teacher in a local private school."

Last month a note from **Enrique Guinand** came from Caracas, Venezuela. He writes: "After 23 years with the sugar industry in Venezuela, I will work now with a company that manufactures material handling equipment under license from Radistant and Continental Conveyor.

This last summer we were all inspired by pictures of our president (the USA, that is) jogging through the woods of Maine. Although news pictures show **John Sununu** at the president's side almost all the time, I have never seen him jogging alongside. Take care, John, some very important decisions are made while jogging. Don't miss out. I'm sure we can get someone to contribute a full jogging outfit and help you train.

Some pretty impressive promotions during the last year. **Ed Hessler** became vice-president and general manager of Upjohn's Chemical Division in Kalamazoo. . . . **Ronald Yoo** rose to vice-chairman at Shearson Lehman Hutton in New York last spring. . . . **Gordon Guttrich** moved up to principal scientist at MITRE Corp. . . . **Steve Thomas** moved up to quality staff director for Phillips Petroleum in Bartlesville, Okla. His job will be to establish a company wide "total quality" effort. . . . Finally, **Sheila Widnall** got an honorary ScD from Smith last June.

As the snow falls and the numbing cold of December chills the bones, think of spring and the glorious opportunity to return to Cambridge and fight off the fund-raisers. This time we gather on June 7-9. I expect you all to be there and behave yourselves for a change.—**Andrew Braun,** secretary, 464 Heath St., Chestnut Hill, MA 02167

# 62

**Eugene F. Finkin** writes that since December 1989 he has been president of Keller Building Products, a $150 million national manufacturer headquartered in Miami, Fla. Gene says that his company is the result of a positive LBO turnaround. We wish him well with his new company and continued success as a corporate financial

wizard. . . . **Kenneth A. Rahn** continues to serve on the faculty of the Graduate School of Oceanography at the University of Rhode Island. Ken has two children—Kenny Jr., 17, and Gail, 14. Ken has been both mother and father to them since his wife, Julie, died in April 1989. We extend our sympathy and best wishes to Ken and his family as they continue to cope with the loss of their loved one.

We regret to report the death of **Alan Walfred Carlson,** who died in Beverly, Mass., on June 4, 1990. Alan was the founder of Carlson Electronics, Corp., of Peabody, Mass., a designer and fabricator of automatic test systems. Born in Waltham, he received his SB, SM, and PhD, all from MIT in electrical engineering and solid state physics. Alan was an avid sports fisherman, past president of the Beverly Cove Community Center, member and former deacon of the First Baptist Church in Beverly, and a member of the IEEE and MTT. He is survived by his wife, Sandy; children (Wendy, Heidi, and Scott); daughter-in-law, Deborah Carlson; mother-in-law, Eleanor M. Beaton; brother, Paul Carlson; and sister, Dorothy Leighton. We wish to thank Sandy for sending the Alumni/ae Association his obituary, which appeared in *The Beverly Times.*

**Xavier L. Simon** writes that he is currently division chief of Finance, Industry and Energy at the Economic Development Institute of the World Bank. For the last three years, Xavier has been developing and delivering training programs in three fields for developing county senior officials and executives throughout the world. His oldest daughter, Valerie, graduated from the College of William and Mary, in Williamsburg, Va. Daughter Michele is attending Marymount and Xavier UVA. He and his wife, Gail, extend an invitation to classmates to drop by for a visit if you are in the vicinity of Washington, D.C. Xavier and Gail live at 1223 Somerset Dr., McLean, VA 22101.

My wife, Mary, and I also extend a warm invitation to visit with us in Gloucester, Mass., if you are in the area during August or early September. We live at 28 Old Nugent Farm and are listed in the Cape Ann phone book under **Henry N. McCarl** and Mary F. Rhinelander.

Keep those cards and letters coming in. Since this column will appear in the November/December issue of the *Review,* I wish all of you a merry Christmas and a happy 1991. Drop a line to: **Hank McCarl,** secretary, Box 352, Birmingham, AL 35201-0352

# 63

You made a respectable effort this time, guys and gals. I have news to report from a phone call, some press releases, and notes sent with financial contributions. Please keep up the good work.

**Dave Johnson** called in late July. He is one of our class's entrepreneurial types. About two years ago he started a personnel referral service, under the name Galen Giles Group. The company is specializing in environmental and food professionals. However, it handles recruiting for any type of engineering, manufacturing management, or human resources. So, whether you are looking for an employee or for a new position, call Dave at (203) 453-5511. He would love to help one of his classmates.

**Jim Dodge** is living not too far from me, in Bowie, Md., (12324 Firtree Dr., 20715) working for NASA at its Washington headquarters. He reports that NASA has a "Mission to Planet Earth." A key component of it will be Jim's project, "Global Energy and Hydrologic Studies." . . . **Howard Leibowitz** has moved from Corning, N.Y., to Upper Nyack (closer to New York City) to become vice-president and COO of Grant Industries.

Last issue I wrote that **Tom Gerrity** left Computer Sciences Corp. and its division Index Group, Inc., for the Wharton School of Business. . . . If I understand a press release correctly, CSC has now promoted **Jim Champy** to senior vice-president. He continues as chair of Index (of which Jim and Tom were cofounders). All this was also in a May issue of the *Wall Street Journal,* but I am not capitalist enough to read it, and maybe you aren't either.

The American Society of Mechanical Engineers has named **Richard Salant** a fellow. According to the ASME release, this requires 10 years' active engineering practice and "significant contributions to the field." Richard is a professor of M.E. at Georgia Tech.

Keep those phone calls and notes coming!—**Phil Marcus,** secretary, 3410 Orange Grove Ct., Ellicott City, MD 21043, (301) 750-0184

# 64

*Bonjour, mes amis. Comment allez vous?* When both of the Alumni/ae Fund notes that arrived this month were from France, it seemed as though a somewhat different greeting for this column was in order.

**Sam Taub** writes that he is enjoying living in Paris with his wife Gaby and their two children, Josh, 18, and Sara, 15. After finishing a postdoc in physics at the University of Paris in 1970, Sam switched into the computer field. He is currently director of marketing at Storage Technology France. . . . **Leslie (Bud) Boring** has recently joined Canadian Imperial Bank of Commerce in France as director of real estate development and finance. He has spent 17 years with Citibank and views the change as an opportunity to "at long last" put down roots in France and enjoy home outside of Paris on a more permanent and stable basis of career outlook. Bud invites all of his MIT friends to call whenever passing through Paris. . . . In April (speaking of Paris), **Larry Rabiner** was elected to the National Academy of Sciences in recognition of his distinguished achievements in original research. Larry is the head of the speech research department at AT&T Bell Laboratories in Murray Hill.

Acceptance letters from the Institute's Admissions Office brought good news to the offspring of at least two of our classmates. **Emilio Sardi** wrote from Cali, Colombia, to say that his eldest daughter Giovanna entered MIT this fall and will probably study economics. Emilio and wife Liliana are quite proud of their daughter's accomplishment. . . . Former class president **Carl Uhrmacher** wrote that his oldest son Mark is a new member of the class of 1994 at the Institute with a strong interest in computer science. Mark has been helping solve computer problems at CARLTECH, the firm founded by Carl and his wife, Barbara Pollack ('66). A little extra work in high school and over the summer at Towson (Md.) State University enabled Mark to advance place freshman calculus. As a result, he will perhaps have a bit of spare time to pursue his interest in the sport of ultimate frisbee. The Uhrmachers are looking forward to attending Parents' Weekend (as viewed from the other side) in Cambridge.

After more than four years of flailing away, I have finally figured out that in golf (unlike all the other sports I have played—squash, softball, tennis, soccer, etc.), the ball is not moving when you hit it. It's amazing how much easier the game is when you swing slow and easy. These low sigma, decreasing mean scores are kind of fun and Louise would probably testify that it makes me a much more civil golfing companion. Well, enough phys ed revisited. Be warned: if you don't send some news about yourselves, I will be forced to use the space in the column to share many of the other secrets of life I have learned.—**Joe Kasper,** secretary, RR 2, Box 4, Norwich, VT 05055

# 65

**Bruce Morrison** was endorsed in July by the Connecticut Democratic State Convention as candidate for governor, but faced a September runoff primary. Morrison, a four-term congressman from Hamden, received 69 percent of the vote. Morrison went from MIT to Yale Law School and then spent eight years with the New Haven Legal Assistance office, the last six as its director, before his election to Congress in 1982. Morrison is expected to win the Democratic nomination but has an uphill battle against Lowell Weicker for the election. We wish him well in his campaign.! . . . **Richard Tsien** reports he has been at Stanford for the last year and a half, starting a new department of molecular physiology. His current research is on memory mechanisms.

At the reunion, we enjoyed a chance to see **George McQuilken.** George may hold the record in the class for starting the most companies (five). His latest endeavour is called CodeScope and is focused on mainframe software efficiency. George continues to weigh in (at over 300 lbs.) as the most substantial presence in the class.

**David Ellerman** reports that he is the U.S. coordinator for a Yugoslav entrepreneurship project to create eight entrepreneurship development centers in Yugoslavia. David consults and lectures on worker ownership. . . . Also in the international vein we received a letter from **Leonardo Peusner** apologizing for missing the reunion because of a Fulbright grant to teach in Argentina for the summer. . . . **Craig Wheeler** also reports a Fulbright, to Italy. Craig has been department chair of the University of Texas Department of Astronomy, and spends time between Austin and observatories in Tucson and Chile. In his spare time, he has written a novel, *The Krone Experiment,* that did moderately well in paperback. He has two children, Diek (MIT physics, '89) and Rob (a sophomore at Stanford).

**Bruce Sunstein** reports that his law firm, Bromberg & Sunstein, has grown to seven lawyers and specializes in patent, trademark, and copyright law. Bruce has handled patent work for several companies in which I was involved. He came back to Boston in 1979 after a stint in graduate school in English, law school at Berkeley, and practicing law with a major San Francisco firm. His wife Rachel is a professional pianist and they have a son Aaron, age 3. . . . **Marlene LaVerne (Hiller) Jorris** reports she is now practicing emergency medicine. After leaving MIT, Marlene worked as a "senior engineer and spy" for the government and then went to George Washington for medical school.

The class extends its congratulations and thanks to **Steve Lipner** for his many years of handling the secretarial duties for this class. Steve kept a healthy dialogue going among many members of the class in spite of often empty mailboxes (please note—letters always welcome).

On the home front, I left my position as managing partner at American Research & Development at the end of 1989 and am in the process of raising a new venture capital fund, the Beacon Venture Fund, to focus on manufacturing and materials-processing innovations. My partner, Frank Nolfi, had been vice-president for technology at Alcan Aluminum. We expect to close by mid-1991.—**George McKinney,** secretary, 33 Old Orchard Rd., Chestnut Hill, MA 02167, (617) 890-5771

# 66

Please send news for this column to: **Jeff Kenton,** secretary, 7 Hill Top Rd., Weston, MA 02193

# 67

**John Rudy** writes that he was asked by the class of 1990 to participate in a program of seminars to share his knowledge of resume writing and job interviewing. He also reports that the class of 1992 has adopted our class as a "buddy" class. John attended a dinner with the object of passing on any lessons learned during and since MIT to about 40 members of '92. Others attending the dinner from '67 included **Jeff Wiesen, Jeff**

Shapiro, Jim Foster, Chuck Kolb, Dan Corwin, and **Peter Vale.** As for family news, John and Janice's daughter, Hilary, who is an eighth grader, is performing in the *Pirates of Penzance.*

**Alan Perelson** is a staff member in the theoretical biology and biophysics group at the Los Alamos National Lab, and a professor at the Santa Fe Institute, where he leads a research program in theoretical immunology. . . . **Arnold Lieberman** has been a systems programmer at the H.W. Wilson Co., a major publisher of indexes and references for the past five years. For the last two years, he has been working on a new networking system which should soon be available.

**Tom Baer** is now with the Department of Experimental Psychology at the University of Cambridge. . . . **Margaret Jones** writes that she has remained in the same apartment in New York since 1971, since whenever she thinks of moving she redecorates instead. Margaret is a vice-president at Prudential Bache, following electric and telephone utilities in the corporate bond department. . . . **Ruth McDowell** presented a slide lecture entitled "Nature in Quilts" during last June's 25th Annual Needlework Day of the Guild of Strawberry Banke, Inc., in Portsmouth.—**Jim Swanson,** secretary, 878 Hoffman Terr., Los Altos, CA 94024

# 68

As I swelter in the late-August heat, it is hard to believe this will not appear until winter. I can only hope the publication of this column finds world events in less of a turmoil than they are as I write.

Several members of our class have been elected to the rank of fellow of several professional societies. Those of the American Physical Society include: **Eric Weiss,** "in recognition of his work in chemical dynamics with particular reference to vibrational energy transfer studies, transient infrared spectrocopy and laser-based probes of molecule-surface interactions;" **Donald Batchelor,** "for theoretical analysis and code developments in the areas of plasma heating by electromagnetic waves at electron and ion cyclotron resonance frequencies and the subsequent plasma thermalization;" **Stanley Humphries,** "for pioneering work in the invention of efficient ion diodes and in the generation and transport of intense ion beams through accelerating structures;" and **Charles Thorn III,** "for important contributions to the theory of elementary particles." . . . In addition, **Alan Guth** was recently elected fellow of the American Association for the Advancement of Science. We do not have the citation for his election.

We still have several students among us. **Paul Kimball** reports that he has just moved to an Alexandria, Va., law firm as a biotech patent consultant and has completed the first of four years of night law school. . . . **Donald Baker** calls himself an "unemployed graduate student" working on a PhD in agronomy (soil science) at Colorado State, after getting an MS in ag engineering. He also notes, "Finally got my first peer-reviewed paper accepted in Trans-ASAE (in publication)." He plans on calibrating a 2-D computer model for infiltration into plowed soil for his dissertation.

In other news, **Karla Karash** reports that she is still working at Ventana with **Dave Peterson,** Laura Peterson, '69, and Bill Arthur, '69. They have an office at MIT's new University Park development. She also reports that she had lunch with **Art Cole.** He is now in a small firm doing logistics, and he has a college age daughter! Karla reports that her daughter, Ann, is now 13, and is a "terrific kid." . . . **John Dehne** is now president of Loral Infrared and Imaging System (formerly Honeywell Electro-Optics Division) in Lexington, Mass. The divestiture was 16 months long and quite a learning experience. He is living in Andover, Mass., with his wife, Carol, and two teenagers.

**Allan Pollack** practices psychiatry and psychoanalysis in Newton, Mass., and teaches at the Boston Psychoanalytic Society and Institute. . . . **George Owen** has recently accepted the position of director of Design-Build Services for the Shockey Companies in Winchester, Va., after two-and-one-half years as senior architect for the Holland-Gerrard Group in Washington, D.C. . . . **David Kaye** has been selected as Arizona State University Regents' Professor. He will be a visiting professor at Cornell Law School for fall 1990. . . . **Stephen Ostrach** is now legal director of the New England Legal Foundation in Boston.

We have a retirement to report. **Bob Metcalf** writes, "After growing 3Com Corp. for 11 years, I have *retired.''* He and his wife, Robyn, and their children, Julia (3) and Max (1), and their two golden retrievers, escaped to his place in Maine, at least for the summer. In September, he was planning to go back to Silicon Valley and something new, maybe. "By the way," he notes, "3Com passed $400 million/year in sales before they threw me out. All is well." As far as I know, this is the first "retirement" for the class. Let us know if there are others.

That cleans out the mailbox once again, so drop us a line with your latest news.—**Gail** and **Mike Marcus,** secretaries, 8026 Cypress Grove Ln., Cabin John, MD 20818

# 69

Please send news for this column to: **Eugene F. Mallove,** secretary, 171 Woodhill-Hooksett Rd., Bow, NH 03304

# 70

Due to the long publishing lead time, here is a report on the events of last June. . . . Our 20th reunion, thanks to organizer **Gary Blau,** proved a more low-key and mellow affair event than the spring semester of our final year in 1970. More than 50 graduates attended some part of the reunion weekend, many with spouses. In addition to the Institute-wide activities, our class held a Friday night dinner at MIT's Museum (which has some neat plasma balls by J.B. Parker and a great shop), during which everyone stood up and gave capsule sketches of their lives for the last 20 years, a Saturday night dinner dance to a '60s band, and a cholesterol-laden Sunday brunch at a library overlooking the Boston Garden.

Financial consultants, lawyers, and software-writers seemed to abound, as well as a few professors. One of the professors was **Alan Chapman.** He and his wife, who goes by the stage name of Karen Benjamin, entertained everyone Saturday night. Alan and Karen sang a medley of Alan's own songs, including recent creations as well as some dating from his days at TEP. Alan and Karen hope to launch a caberet show, "Life, Love and Antelopes." For now, you can catch Alan's act at Occidental College, where he is the chairman of the Music Department.

The person who traveled the farthest to be at the reunion was **Mary Ann Rivet.** This was her first trip in 20 years to the United States from Paris since she took up residence there shortly after graduation. She is working for Synthilabo and welcomes contact from any classmates passing through Paris.

**Steven Barr** reported that he is doing electrical engineering of the body, that is, he is a full-time acupuncturist. His wife, **Pam Whitman,** is now a full-time artist. They live in Lake Tahoe, Nev., where they have one child and another on the way. . . . **Stefan Klein** is vice president of a small software firm in Burbank, Calif. **Bob DeMarrais** is a software consultant, who calls his company ISIS Consulting. . . . **Reid Ashe** claims to be hawking newspapers on the streets of Wichita, Kans. An informed source tells us that he is the publisher of the *Wichita Eagle.*

**Greg Jackson** explains that, although he is a professor of education at Harvard, he has spent the last two years at MIT continuing the work he began 20 years ago with CJAC. He has been involved in attempts to modify the education reforms of the late '60s and early '70s, including freshman pass/fail and IAP. . . . **Joe Bisaccio** has moved well beyond the pinball business he started as an MIT student into vending machines and real estate. . . . Among the lawyers were **Jim Finder** and **Duane Shinnick.**

Among the bankers and investment bankers were class president **Steve Carhart,** who is with Northern Trust in Chicago; **Bob Dennis,** with Massachusetts Financial Services in Boston; and **John Friel,** with Donaldson, Lufkin & Jenrette in New York. . . . **Tim Dalton** is the university publisher for Harvard. . . . **Mike Bromberg** runs a company called 3 Ring Circuits, which does consulting on electrical engineering projects, such as a design for a parallel processing super computer. . . . **Jeff Hankoff** has a family practice in medicine in the San Francisco Bay area.

At the final brunch, class officers were chosen for the next five years: **Steve Carhart** will continue as president; **Bob Dennis** will be vice-president; **Gary Blau** will be treasurer; and **Greg Arenson** (to be helped by **Karen Wattel Arenson)** will be secretary. We failed to shanghai anybody for class agent, so be on your guard. Any suggestions for next reunion—in 1995—are welcome. So are notes to this column. Please write to us.—**Greg** and **Karen Arenson,** secretaries, 125 W. 76th St., Apt. 2A, New York, NY 10023

# 71

**Avi Ornstein** writes: "I have received one of the 1990 Celebration of Excellence Awards given to teachers in Connecticut. I am receiving it for the program I developed on nuclear energy education which requires students to investigate both sides (pro and con) of the controversy." Avi has always dedicated himself to helping others, and it is nice to see that his help and dedication are being recognized and rewarded.

*Class Reunion.* Our 20th reunion will be held June 6-9, 1991. Please make plans to attend, and we hope you'll write or call others who were in your living group or were friends at school and encourage them to come, too. The 15th reunion was lots of fun for all concerned. No one was too worried about trying to impress anyone. I think that situation will improve even more for our 20th.—**R. Hal Moorman,** secretary, P.O. Box 1808, Brenham, TX 77834

# 72

**Charlie Smith** writes that he visited Prague last summer as an N.A.S. exchange scientist and had a great time. He is associate professor of statistics and biomathematics at North Carolina State and is looking for a replacement for his bush hat. . . . **Daniel Nadler** is taking on an associate in his ophthamology practice and has published a textbook, *Glare and Contrast Sensitivity for Clinicians.* . . . **James Mosora** works at the Air Force Center for Studies and Analysis and was recently promoted to lieutenant colonel. . . . **Cyril Draffin** announces that after 39 years of bachelorhood, he has married Christine Berg, a radiation oncologist at Georgetown Medical. They live in Bethesda, Md. . . . **Allan Kirkpatrick** is associate professor of mechanical engineering at Colorado State. He does research in the area of heat transfer in buildings and recently completed a study recommending an atrium for the new Denver Airport Complex. . . . **Carol Epstein** was named vice-president of ImmunoGen in Cambridge. . . . **George Lawrence** is chief executive officer of Phoenix Resource Companies, Inc., in Oklahoma City. . . . **Edward Fox** was executive producer and script writer for "Interactive Digital Video," an hour-long documentary available on videotape from the Association for Computing Machinery. He was also project director for a series of three

CD-ROMs.

**Jeffery Kaufman** is in his fourth year as associate professor of vascular surgery in Albany, N.Y. His wife, Catherine Eisenmenger, is nearly finished with medical school. . . . **Rafael Bras** was recently named associate director of the Center for Global Change Science at MIT and to the Board of Atmospheric Science and Climate of the National Research Council. He delivered a talk on Climate change and agriculture at the Food and Agro Meeting during the World Economic Forum, Davos, Switzerland, in February. . . . **Douglas Mahone** writes that in August 1989 he moved to Sacramento to work for ADM Associates as director of architectural research, still specializing in building energy efficiency. Wife Lisa Hescheng, MArch '78, designs schools with Stafford King Associates. "The kids have made it to fourth and first grades and are thriving." . . . **Conor Reilly** is a lawyer with the firm of Gibson, Dunn, and Crutcher in New York, specializing in insurance industry corporate work. He, his wife, and two children live in Short Hills, N.J., where he serves on the Millburn Board of Education.

And now a contribution from our president. **Bonny Kellermann** writes, "I'm in my tenth year as director of the Educational Council and Associate director of admissions at MIT. I can hardly believe that I've held the same job for ten years—me, who changed majors eight times as an undergraduate! The job does give me a good opportunity to keep in touch with many MIT alumni/ae, including a number of classmates. If anyone missed the opportunity to get a class sweatshirt at the last reunion, I have some still available. Write with your size and a $15 check payable to the Class of '72, or stop by my office at MIT (Room 4-240, Cambridge, MA 02139). Speaking of reunions, we are closer to our 20th than our 15th. (Now there's a scary thought.) If anyone has suggestions or would like to be involved in the best reunion ever, let me know."—**Dick Fletcher,** secretary, 135 West St., Braintree, MA 02184

# 73

We haven't got a heck of a lot to report this edition, folks, and I'm sure you're doing more than we're hearing!

**Alan Lehotsky,** after 13 years in Lexington, has pulled up roots and moved—one and a half blocks to another house there. He is working for the Open Software Foundation, close enough to the 'Tute to see the Great Dome out his office window. He is managing a dozen engineers working on Unix commands, libraries, and compilers. Managing, quoth he, ranks closer on the enjoyment scale to fun (rather than the root-canal end). His wife has been taking calculus in preparation for a second SB. Alan has been helping, and suggests that Professor ("Otto," "Matt") Mattuck would be happy that he still remembers a bit of 18.01 and 18.02 despite 20 years of non-use. Not that anyone cares, but I was asked by one of my kids the other day what calculus was, and all I remembered was something about measuring the glass of Kresge. Sorry, Otto.

**Jeff McGillivray** has filed as a Republican for a seat in the New Hampshire House. The primary will have been held on September 11 for a November 13 election. A New Ipswich resident, Jeff has been an active member of several local committees.

Robert ('71) and Sonia Ryczak visited on a July weekend (most spent in the pool). Assorted tales of old Phi Delts wafted into the air (and floated away as their veracity dictated).

Our sympathies to the family of our brother Brian van Lierop ('75), who passed away this past year.

Brighter news to come, but it must come from you—write!—**Robert M.O. Sutton, Sr.,** secretary, "Chapel Hill," 1302 Churchill Ct., Marshall, VA 22115

# 74

Yo, classmates. Lots of notes came in this past month. I don't know though. . . . there's a certain, well, *settled* feeling about the things people have to say. Someone even had the audacity to call this time in our lives middle age! Troops! For the second time (and certainly not the last): middle age is 50! Maybe it's having children that does it, or maybe because all the notes were written in the heat of July. Let's hear no more of this getting old stuff! Not yet, anyway.

First up is a handwritten letter from **David Donato.** David is 10 years married to Liberte, with a son and a daughter. He is currently an operations research analyst with the U.S. Department of Interior's U.S. Geological Survey in Reston, Va. . . . **S. Jeffrey Rosner** writes that things are slowing down. After five years of frenzied activity at Stanford grad school for his PhD, renovating his home, starting a family, and holding down a full-time research position at Hewlett-Packard, he's finding the time to get into woodworking and is spending more time in the mountains. Sounds nice. . . . "I'm doing the same old thing (family practice) at the same old place," says **Elizabeth Wise** about her job. The family news is more exciting. She and **Jock Young** had their third child, Sierra Dawn, a bit over a year ago. He's had to design a staircase blocker to keep Sierra out of mischief. The older kids, Jonathan and Julie, are catching on to unicycle riding, and Jock's starting a local unicycle riding club. . . . **John R.H. Black** made three trips to Australia from Pittsburgh for Alcoa in the first half of 1990. "Still recovering from jet lag." Also, "Hello to all my buddies from Course III." . . . "My wife, Marie, and I are expecting our third child" by the time you read this, says **Martin Cohen.** "Our two older girls, Jessica and Rebecca, are doing well in school and growing by leaps and bounds." Martin is now group leader of the Photochemistry Group at the Chemical Research Division of American Cyanamid in Stamford, Conn.

**Frank Morgan** has been enjoying his years as chairman of the Williams College Mathematics Department. This next year he's on sabbatical, going to the Institute for Advanced Study at Princeton. . . . From Israel comes news from **Aviva Weisel Eichler.** She and husband David and their four boys moved to Beersheva in 1987. She is working in the Virology Department at Ben-Gurion University of the Negev. . . . Your faithful scribe was not quite sure what **Norman Mazer** meant when he said he had "finally become green." Green like money? Green like Kermit the frog? Actually, Norman writes, green like ecology, green like Earth. He and Marion were active in the Salt Lake City Earth Day 1990 movement and are founding members of a new environment group, Eco Scouts. Call for more information: (801) 269-9412. . . .And speaking of green like money, Class Treasurer **Marty Davidoff** would like you to know he merged his firm with another accounting firm a bit over a year ago. The new venture, over 50 persons strong, is known as Wilkin, Guttenplan, and Davidoff, P.C. CPAs.

We'll close this month's epistle with a few quotes from fraternity brother **John Hurd.** By way of background information, when John married his wife, Elaine, she had five children from a previous marriage. What he is going through may seem a bit advanced for his years, but John always was more than a bit advanced. "Elaine and I are still happily married after 15 years. The kids are all grown up, all married except for the youngest. Three grandchildren so far, two boys and a girl. It is fun to spoil them rotten and then turn them back over to their parents. . . . As usual, I travel a great deal. I'm president of a small company selling software for mechanical engineers. Since we are small, there is a lot of territory to cover without a lot of people. We seem to do pretty well. In a tough economy, revenues continue to grow and we make payroll well enough. Most of the users are Fortune 500 for the advanced products and a large number of small accounts for the CAD software. We have a good distributor in Japan and a staff of six in Europe, so I am in each area at least twice a year. If anyone needs MCAE tools, give me a call."

Keep warm. Keep writing.—**Lionel Goulet,** secretary, 115 Albemarle Rd., Waltham, MA 02154-8133, (617) 899-9694

# 75

Here's the news from our classmates. . . . **Alexander B. Henry** recently joined the William Morris Agency (WMA) as director of Information Services. He previously was a manager in the consulting division of Deloitte & Toudre. He is presently responsible for all information services at WMA including implementation of a large network of Next computers.

Since last he dropped a line, **Miles R. Fidelman** has had a daughter, Tracy, who is now 2 years old. Another child is/was due in November. . . . **Robert P. Schreiber** has a new position at Camp Dresser & McKee, Inc., of Boston. He is now associate; his former position was principle engineer (Should that be principal? Or were you engineering new principles?) All spelling mistakes are to be blamed on the May 13, 1990, *Boston Sunday Globe,* the source of this news.

I received a press release from Origin Medsystems, Inc., announcing the availability of its first product—the Cement Extraction System developed by **Albert K. Chin** and colleague, Hank Wuh. The system is used for revision hip arthroplasty (that is, the replacement of artificial hips that have loosened over time).

**Lawrence H. Summers** is the author of a new book, *Understanding Unemployment,* published by the MIT Press. The book explores new theories of joblessness that could eventually explain why unemployment remains high despite relatively healthy economic growth. It is based on the notion that joblessness is an important, measurable, and definable concept of pervasive importance in modern economics. Lawrence is professor of economics at Harvard University and research associate at the National Bureau of Economic Research. He is editor of the series, *Tax Policy and the Economy.*

I received a nice note from **Janet C. Johnson** informing us that she has been selected for a special one-year assignment at the Pentagon as a research specialist in the Office of the Secretary of Defense. She will be taking a year off from her normal job as a seismologist at the Air Force Geophysics Laboratory in Bedford, Mass. She can be reached at the home of Lynn Reed, '73, at (301) 593-0090. Besides studying unusual earthquakes, Janet has been busy studying voice and doing historical costume design for theatre.

That's it for now. Keep writing.—**Jennifer Gordon,** secretary, c/o Pennie & Edmonds, 1155 Ave. of the Americas, New York, NY 10036

# 76

Please send news for this column to: **Arthur J. Carp,** secretary, Voice Recognition Technologies, Inc., 220 Henly Rd., Woodmere, NY 11598, (516) 295-3632, Fax: (516) 295-3230

# 77

It is with great sadness that I report the death in June of **James E. Kraft** of Scarborough, Maine. James, a member of Theta Xi, was a structural engineer for United Engineering and Constructors in Boston at the time of his death. We extend our heartfelt sympathy to his wife Catherine and his infant daughter Catherine, as well as to his parents, grandparents, and siblings.

**Debbie (Hoover) Dobson** enjoys being back in

Houston after a three year assignment in New Jersey: Working again at Exxon Production Research on sub-sea oil wells is much better than corporate planning. . . . **Eric Black** puts in long hours at his fourth start-up company, Atherton Technology, and he says," This one looks good! Life out in the redwoods is good, and Silicon Valley is a *very* small world. Greetings to all. Give blood."

In San Francisco, **Tom Mills** plans to enter the MPH program in health policy and administration at the U.C. Berkeley School of Public Health. For the past five years he has been practicing psychiatry. Twice in the past year he has given a symposium on being an HIV-positive psychiatrist, and he reports that his health is holding out with no particular progression of his AIDS-related complex. . . . From Northern Virginia, we plan to head south later this month for a visit to family in Savannah. This fall, I will continue to overcommit myself with volunteer activities, including chairing the fundraising program at Joia and Kellen's Montessori School, vice-chairing the Northern Virginia Educational Council, running the church bake sale, and running our area coupon club. I really love being busy with these kind of activities in the community. I wouldn't trade any of this for a "real" job. I am here with and for the children while they need me; there's nothing more important! I hope you are as happy doing your thing as I am doing mine. Write soon.—**Ninamarie Maragioglio,** secretary, 8459 Yellow Leaf Ct., Springfield, VA 22153

# 78

We have a good deal of news about classmates this issue from all parts of the U.S. . . . The "peripatetic" **Geoff Baskir** is on the move again—to Washington, D.C., where he is helping keep the airports in our Nation's Capitol safe for the traveling public. Geoff is a lead airport planner for Parsons Brinckerhoff, which has loaned him to the Parsons Management Consultants joint venture to oversee the redevelopment of National and Dulles Airports. Geoff apparently was "in action as the 'Flying Parsons' at the Volley 'Ball' on the Mall on June 10." Geoff now lives in Burke, Va. . . . **Dave Mayer** says he is still at Boeing, New Airplane Program. He married Colleen Cook on June 23, 1990. **Drahomir "Mike" Lazar** was the best man. Dave and Colleen are living in Renton, Wash.

From Bedford, Tex., **John Jaynes** writes us of a crisis he's encountered. "My daughters (ages 6 and 3) are starting to develop accents, despite frequent trips to other parts of the country (courtesy of flight benefits). Is this a reversible process?" . . . Congratulations go to **Dave Kindler** and **Patricia Fennessy,** who were married on May 20, 1990, in Concord, Mass. Dave is working for Digital Equipment, and Patricia is a hydrogeologist for ENSR in Acton, Mass.

Through a local news clipping, we learn that **Ken Cameron** is scheduled to pilot the NASA shuttle mission that will launch the Gamma Ray Observatory in 1990 or 1991. After high school and before entering MIT, Ken enlisted in the Marines and flew combat missions in Vietnam. He has been a test pilot since then and has flown over 2,700 hours in 46 different aircraft. Ken, who is a ham radio operator, will be talking from the shuttle to amateur radio operators around the country as part of a program sponsored by the American Radio Relay League. Ken lives in Houston, Tex.

**Norm Sheppard** is an assistant professor of biomedical engineering at the Johns Hopkins School of Medicine. He was selected for a 1990 Young Investigator Award for his work with biosensors. (It's reassuring to have someone our age still get an award that has 'young' in the title!) Norm is developing a glucose sensor that may be used to control insulin pumps implanted in diabetics. Norm co-founded Micromet Instruments in 1982, a company that manufactures sensors and instrumentation for characterizing thermosetting polymers. Our congratulations go to Norm.

**Sheila Luster** sends us the latest news from The Colony, Tex.: "We're still in the Dallas area, though we're moving to a new house this weekend. We sold the first victim of Sheila's house renovation business. . . . Next! Kevin Wade, '79, is upgrading to MD88 co-pilot (from 727 flight engineer) with Delta Airlines. He's still quite thrilled. We expect an addition to our crew of three in late October 1990. Erika (2) has finally



*A. Kwai*

gotten her wish." . . . **Andrew Kwai** has joined the staff of Radiologists of the Finger Lakes in Clifton Springs, N.Y. Andrew received his medical degree from Mt. Sinai School of Medicine in 1983 and received board certification in nuclear medicine from Harvard in 1987.

To avoid packing for a move to Berkeley (Calif.), **Barb Ostrom** brought us up to date: "I am aiming at a PhD in civil engineering with a transportation specialty. Obviously, I haven't gotten too far from my MIT educational bent. Professionally, I am quitting the Maryland State Highway Administration after eight years there, through four reorganizations and three changes in title. I managed to obtain professional registration as an engineer. For someone who's done nothing but listen to design engineers while doing traffic forecasting, I was frankly amazed to have qualified to take the test, much less pass on the first attempt." Barb has been traveling too, including a cruise around South America through the Straits of Magellan, side trips to Iquitas and Machu Picchu ("amazing"), and a cruise through Singapore and Indonesia ("Americans drive on the wrong side of the road!"). Barb was also appointed to a transportation research board committee. Best of luck to Barb in her new undertaking.

From Piscataway, N.J., **Diane (Prignoli) Semmling** relays a story of serendipity and romance: "On Saturday, September 23, 1989, I was involved with the Coast Guard Reserve in a 'mobilization exercise' guarding a condemned pier while the (attenuated) Hurrican Hugo raged. It was there that I met my husband, Thomas Warren Semmling, who was serving with us as a National Guardsman. Tom and his fellow MPs were dressed like a pile of hedge clippings, but behind that battle dress uniform, there was something unique and strangely magnetic. Well, we married in November 1989 and bought this house in picturesque Piscataway. Our first child is expected to arrive in early 1991. Currently, we happily tend to life in the suburbs with Bijou our cat, our noisy lawnmower, and our tomato garden."

Your class secretary and wife, **Diane Curtis,** now have a farm, located near Granville, Ohio, about 35 miles east of Columbus. The town definitely has a New England flavor to it and is the most attractive to us of the small towns we've seen in Ohio. It turns out that the town was founded by settlers from Granville, Mass., in 1806. We learned of the farm during a stay at the Granville Inn to celebrate our 5th wedding anniversary. So we now own 40 acres, complete with woods, pasture, stream, and two barns. We will be breaking ground for a house next spring, after we put a culvert across the stream this fall. We'll also be starting crops next spring. We are very excited about this undertaking, and are actually looking forward to all of the work!

Send us your news (pictures are always appreciated, too!).—**Jim Bidigare,** secretary, 2470 Billingsley Rd., Columbus, OH 43225, (614) 889-1817; **Julie Kozaczka Stahlhut,** assistant secretary for Networks, Internet; jstahlhu@hstbme.mit.edu; Compuserve; Julie K. Stahlhut 76566, 1012

# 79

**Beverly (Shluckebier) Wright** is a housewife in Bear, Del., with two children—Alan 6, and Dianne, 3. Her hobby is genealogy, and earlier this year she visited D.C. for a weekend to hunt in the Library of Congress. . . . **Marvin Chartoff** and Janice (Cohen) Chartoff, '81, had a daughter, Hannah Marie, on April 19. Hannah weighed in at an impressive eight pounds, nine ounces. The Chartoffs live in Fairfax, Va. . . . Another new arrival: **Audrey Greenhill Lones** and **Paul Lones** had their daughter, Amy Kathryn, on December 16, 1989. They are "enjoying her immensely and are adjusting to a more hectic life." The Lones family makes its home in Cumberland, Maine.

**H.C. Mark Chan** writes, "Finally, I have got my new general physical principle, the Principle of Asymptotic Proprotionality, published in the *Journal of Applied Mechanics* (ASME), March 1990. Hopefully, it will raise a lot of interests and discussions." Mark lives in Middlesex, England. . . . **George Glackin** was promoted to section head of product development for Procter and Gamble. . . . **Hugh Blumenfeld** released his second album of original songs, *Barehanded,* in February. It is available from Grace Avenue Records, 1779 South St., Coventry, CT 06238.

**Kevin Wade** and his wife, Sheila Luster, '78, are living in the Dallas area and were planning to move to a new house at press time. Kevin is "still thrilled" with his job at Delta Airlines and was planning to upgrade from 727 flight engineer to MD88 co-pilot. Sheila is in the house renovation business. Daughter Erika, 2, was patiently waiting for a new brother or sister, expected in October. (Don't keep us in suspense!). . . . **Brad Myers** is still at Carnegie-Mellon University and has two children, Ryan and Reid.

**Amy Powell Erixon** writes, "I married in September 1989 and enjoyed the participation of **Ron Parton** and Libby Seifel Melnikoff, '78, in the service. Also in attendance were **Marcus Julian,** Libby's husband Steve Melnikoff, '78, Ed Michelson, '78, Eric Zweigel, '76, and Doug Johnston, '76. Milton Roye, '78, led the toasts to the bride. I recently joined Milton in Boston to participate in the christening of his new daughter, Katherine, and saw many from the class of '78 at a function after. Enjoyed a wonderful month's honeymoon in New Zealand and look forward to regular vacations from now on."

By the time you read this, the MIT Alumni/ae Association will have awarded to your faithful secretary the Lobdell Award, which is given in recognition of contributions to alumni activities. In my case, the award is for my "invaluable work as a class secretary." I am tickled to be so recognized, and I hope you all enjoy this column.—**Sharon Lowenheim,** secretary, 98-30 67 Ave., Apt. 6E, Forest Hills, NY 11374

# 80

Greetings! At our 10th reunion last June, new class officers were elected for the next five years. Our previous class secretary, **Kate Mulroney,** is now class president. **Alan Weger** was elected vice-president/treasurer. I, **Kim Zaugg,** will serve as your class secretary and keep you informed of the activities of our classmates through this column. Our new class agent is **Joanne Berenberg, Russell Blount, Tim McManus,** and **Dek Lee** have been elected to the officer-at-large positions.

Last fall, ten of our classmates served on the 10th reunion gift committee. **Joanne Tobias,** the committee chairperson, reports we raised $6,900

BY JOY POTTER

# Black Engineer of the Year

His ultimate goal? "I would like to see minorities represented in higher education at the percentages that they are in the population. If you do that, then all the other economic disparities will disappear."

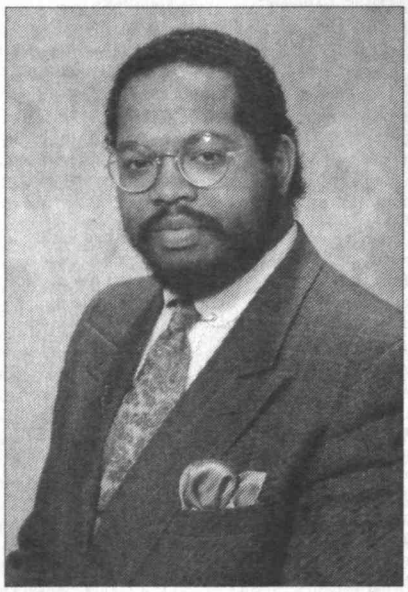
Meet Dr. Alan Letton, '80, assistant professor of engineering at Texas A&M University and the recipient of the Black Engineer of the Year award for his work promoting higher education.

Letton, who received his bachelor's degree in chemistry from MIT, was chosen from applicants across the country by U.S. Black Engineer, a collection of companies and engineering deans of historically African American universities. Mobil and the Career Communications Group were the corporate sponsors.

Ten years ago while in the PhD program at the University of Cincinnati, Letton and several friends saw the need for increased technical leadership in the African American community. They set out to reshape the university's summer enrichment program to encourage high school students to get into engineering and science. To recruit teachers, he says, "I would go out and get the minority engineers and scientists from Proctor & Gamble and General Electric and other technical companies." The classes were free, and the computers were donated by Digital Equipment Corp.

Classes in the morning focused mainly on math, science, engineering, and computers, but afternoons were open for discussion. "Part of what we were trying to do was set a role model so that people could talk about other problems as well." By the time Letton received his PhD four years later, the program had grown from 28 students to 360.

He went to work for Dow Chemical in Freeport, Texas. While there, he joined the National Urban League's Executive Exchange Program, which sends African-American executives on speaking tours through the country to historically black universities. On one such visit, the president of Paul Quinn University in Waco, Texas, asked him to help revitalize their summer program. He accepted the offer and recruited Dr. Van Stuart, another African-American chemist at Dow, to help.



"We wanted to have a program that did a lot of motivating and would help students see how math and science tie into a technical career," says Letton. "Also, we wanted to cover the different aspects of technology, from the basic sciences up to engineering, and then we wanted to get into politics."

The students learned about the methods of science and moved into basic chemistry. They did a lab experiment in which they made polystyrene, and they used their data to design a chemical plant. "They could see right away the difference between a chemist and a chemical engineer," Letton says. "Then we talked about the difference between scientists and engineers."

The students also discussed "trying to be ethical in their practices and the fact that that's going to cost money." They examined how politics, religion, and other aspects of society are related to science. Their final discussion was based on a hypothetical case study: Two people are in a car accident. "One of them has the body totally destroyed, but the brain is alive," explains Letton. "In the other one, the brain is totally destroyed but the body is alive. We tell them that the brain of one goes into the body of the other one. What's going to happen?"

After four years at Dow, Letton realized he was spending a great deal of time working with students, and he decided to return to academia. He is now at Texas A&M doing research on polymers. He is focusing much of his energy on encouraging minority graduate students. "I'm trying to get them to understand the direct link between their success and the success of their children and their brothers and sisters," he says. He has 12 graduate students working with him on his research, and his door is always open to anyone who wants to talk.

He has also been working to start a program to endow chairs sponsored by the National Society of Black Engineers. "A lot of the reason minority students don't go to graduate school is that they don't see anybody that they can work with, that they can relate to," he says. "If you can get more women and minorities into faculty positions, then more women and minorities will be willing to come as students. That's what's happened since I've been here. I haven't had any problems recruiting minority students."

Letton is also working with a friend on a novel. "I started it because I wanted to improve my writing skills," he says, "something away from technical writing. But it's become a very serious piece of work. We're looking at the evolution and possible destruction of the African-American community and family, and what elements in society are causing that. A lot of the problems and stress that our families are going through have to do with the way we're viewed right now by society."

For the future, Letton wants to continue doing technological rather than administrative work. "People have been saying that long-term they would like to see me go into a dean's position. But my heart's really in the technology, research, and teaching. It would be very hard to leave that right now." □

*The author is a free-lance writer.*

more than our goal of $50,000. Our class designated $34,519 to the Class of 1980 Student Aid Fund, well over our goal of $20,000. More than 150 gifts were $100 or more. The class participation rate was 44 percent. This was a great year for the class of 1980. Joining Joanne on the committee were **Robert Adu-Gyamfi, Mark Connaughton, David Damery, Elizabeth Fisher, Frank Huston, Elizabeth King, Tabetha McCartney, Cynthia Reedy,** and **Kim Zaugg.**

More news from the spring and summer of 1990: **David Isaacson** and his wife, Judy, recently moved back to Massachusetts from New Hampshire. David was promoted to manager in product marketing at Bull HN Information Systems. . . . Also on the move, **Eric Swenson** writes that he and his wife, Tamah, recently moved from Carlisle, Mass., to Santa Cruz, Calif. Eric is employed as a senior software engineer at Borland International, one of the leading suppliers of personal computer software. . . . **Joseph Brosz** is at the Swiss Federal Institute in Zurich, Switzerland, where he is researching domain wall dynamics and magnetic nucleation and finishing a PhD in theoretical physics. . . . In May 1989, **Matthew Steele** and his wife, Randi, moved from Harrison, N.Y. to Houston, Tex. Both are working for Texaco and enjoying life in Texas. Their first child, Joshua Maxwell Steele, was born in September 1989; Matthew reports he's a big kid and a real Texan!

His first year of law school at American University just finished, **Paul Edelstein** is now working as an independent consultant in reliability engineering. . . . After finishing his residency in July 1989, **David Kaus,** has entered private practice in orthopedic surgery in St. Cloud, Minn. David and his wife are looking forward to the birth of their second child in October. Their daughter, Katie, is 2 years old. . . . **Michael Van Riper** writes that he has left Hewlett-Packard and is now software development manager at Metaphor Computer Systems.

**Denise Martini Southworth** married Matthew Southworth, SM '80, in 1984. Their redheaded daughter, Laura Margaret, was born this past March. Denise, a project manager at O'Brien-Kreitzberg and Associates (a construction management firm in San Francisco), has worked on some interesting projects including rehab of the San Francisco cable car system and upgrade of the world's largest wind tunnel at NASA's Ames Research Center. While working on current projects at UC/Berkeley she flatters her coworkers by telling them she graduated from the other No. 1 engineering school in the country!

**Emerson Yearwood** finished business school at Yale in 1987 and spent a few frustrating years doing international tax at the IRS. He is now a corporate "jack-of-all-trades" with Automated Sciences Group, Inc., a minority owned consulting firm in Silver Spring, Md. Emerson says so far it's been a great improvement!

Next time you are in Wilmington, N.C., be sure to call **Mark Karlen.** Mark is starting his private practice in anesthesiology there and says the beach is great. . . . Also practicing anesthesiology is **Sherman Shlomo Elspas.** Sherman and his wife, Rachel Yaffa, live in LA's South Bay area where they designed and built their dream house. While in Israel earlier this year, they visited with Shalom (Avery) and Chaya (Cheryl) Lampert, '82, and Jeremy Barkan, '81. Last winter Sherman won three silver medals in NASTAR giant slalom competition.

**Steve Semken** finally received a PhD from MIT in Course III (materials science and engineering) in August 1989. He writes that he is now back at his real job, teaching geology and chemistry at Navajo Community College in the high desert of the Navajo Nation in Shiprock, N.M. Steve says trying to learn Navajo makes 3.21 seem like a piece of cake.

**Martin Plys** writes from Chicago that he is managing software development and enjoying rollerblades. Martin was unable to attend our reunion because he was in Karlsruhe, West Germany, for a conference.

Many of our classmates were not able to attend the reunion. This column provides a means for us to keep in touch when we can't all be together again. Send me your news—your fellow classmates want to hear from you. Have a safe and happy holiday!—**Kim Zaugg,** secretary, 3115-2A Courthouse Dr., West Lafayette, IN 47906

# 81

Hello Again. Hope it's a happy holiday season for all of you. It's been a little quiet in the class notes department this summer. Hopefully, many of you will make it your New Year's resolution to jot a few lines to your class secretary.

I received a nice letter recently from **Jeffrey Schwartz,** who is now a professor of anesthesiology at Yale University School of Medicine. Jeff, who is also practicing at Yale New Haven Hospital, completed his residency at Columbia Presbyterian Medical Center. Jeff was married to Terry Freed in April 1986, and they have a wonderful son, Justin, now 2 years old. Jeff and Terry attended the wedding in San Francisco last summer of **Fred Tou** and Ellen Ma. Also present for the Bay Area festivities were Ivan Tou, '82, **Dan Vogel,** Frank Camacho, '82, Alyssa Erdley, '82, Cathy Briasco, '82, and her sister, Marie. Very much missed were Irene Baker, '82, and **Tom Chang** from the third clarinet section of the MIT Concert Band. Congratulations to Jeff, Terry, Fred, and Ellen.

**Alan Lichtenstein,** MD, has become a diplomate of the American Board of Anesthesiology and is a practicing anesthesiologist in Dayton, Ohio. . . . **William Watkins,** MD, graduated in 1985 from the Howard University College of Medicine. He completed his residency in emergency medicine in 1988 and became board certified in 1989.

**Michelle Lucier-Glatz** is working as an engineer/programmer for IBM in Raleigh, N.C., in communication products development. She is the mother of two children, 3 months and 2 years.

Finally, **Chuck Markham,** wanted me to remind everyone that our 10th reunion will be taking place in about six months. Please contact Chuck if you would like to participate on the committee. Ten-year reunions traditionally are very well attended, and we look forward to seeing many of you there. Please contact Chuck at 85 Brainerd Rd., No. 610, Allston, MA 02134-4548, if you are interested in helping out. Even if you have not participated in class events previously, please give some thought to working on the reunion. With your help, it can really be a special event. You will receive information about the reunion soon. Please make plans to attend! See you in June.—**Lynn Radlauer Lubell,** secretary, 2389 NW 41st St., Boca Raton, FL 33431, (407) 997-2097

# 82

Please send news for this column to: **Stephanie Pollack,** secretary, 135 Sutherland Rd., Brighton, MA 02146

# 83

It's time to take a minute to jot down what you're doing and send it in for publication. Remember, pretty postcards are appreciated.

**Bril Flint** works at Bain & Co. in Boston. Bril finished a master's at Sloan in 1986, and then went to Bain, where he was promoted to manager in July 1989. In September 1989, Bril married Karen Brittingham. The wedding was attended by classmates **Scott Leonard** and **Jeff Moy.** . . . **Matthew Bendaniel** has taken the job of product manager for Intersystems Corp. in Cambridge. Matthew was formerly a manager at Microsoft, in Redmond, Wash.

**Mark Dewitt** writes that he recently earned, with honors, a master of music in theoretical studies from the New England Conservatory. Mark had been studying for the degree during the past three years while working for Xerox as a software engineer. Mark is moving to California to start an MA/PhD fellowship program at U.C. Berkeley in ethnomusicology. Mark will have plenty of classmates to keep him company in northern California. I just returned from a party hosted by **Mike Santullo,** where several classmates were in attendance, including **Ramana Rao, Jeff Muss, Chris Schneider, Kristin Foss, Brian Jacobs** and **Alan Taylor.** Ramana works at Xerox PARC, and Jeff is starting a PhD in rocket science at Berkeley. Mike and Kristin work at Raynet, which will soon bring fiberoptic communications services to a street corner near you. Chris works very hard for Transpac Software, a company he founded with classmate **Ken Krugler.** Brian works for Security Pacific Ventures and is preparing for a wedding in December 1990. Alan just completed one year of business school at Berkeley and is heading back for round two.

As for me, I just returned from the obligatory post-business-school tour of the world. It was not exactly a vacation (20 cities in 40 days), but it was a hell of a lot of fun. The highlights were getting stuck in a snowstorm on the Matterhorn in early July, and paragliding in the Austrian Alps. However, all good things must come to an end, and for me the two-year vacation is over. Now, it's back to work at venture capital firm TA Associates in Boston.—**Jonathan Goldstein,** secretary, TA Associates, 45 Milk St., Boston, MA 02109

# 84

**Ed Gordon** is returning to graduate school again—this time for a master's of management at Northwestern's Kellogg School. . . . **Richard Benfer** is stationed at the Army's materials technology lab in Watertown, Mass. and has been promoted to Captain. . . . **Joyce Morrill** is finishing her third year as a PhD student in MIT's former department of applied biological sciences, studying antibody production. After receiving an MS in biochemical engineering at Duke in 1987, she married Jeffrey, a Duke graduate, in August of 1988. . . . **Bill Houghton** and his wife Debbie attended the wedding of **Doug Kuller** and Lori Schoonover in Minneapolis this past April. Also attending were Kit Daniel, '83, **Shuur Ahmed** and **Rich Stuebi**. Rich married Tamara in May, in the DC area. Bill has a new job as a systems analyst with Ford, which keeps him busy traveling.

**Diane Peterson** moved to a new apartment in Manhattan Beach. She attended **Ellen Williams'** wedding to Geoff Fitch in Sausalito, Calif. in June. Ellen and Geoff will live in Mountain View after honeymooning in Europe. **Carolina Leonard, Kathleen Harragan,** and **Lillian Chiang** were also at the wedding. Diane says that the Los Angeles young alumni chapter is very active and that she is trying to start a film group. Diane reports that our first class scholarship fund was made to a junior, Yvonne Barrera, an electrical engineering major from Texas who plans to go to graduate school. She is involved with MTG, Club Lucha, UROP, ILP and the Cambridge Institute, and has a very good academic record.

**David Brahm** received a PhD in theoretical particle physics from U.C. Berkeley and will do a post-doc at Caltech. Dave's most recent adventure was bungee-jumping from a balloon. He planned to travel around Europe for a month in the summer, starting at a conference in Sicily. Dave keeps in touch with **Scott Douglass,** who is married to Margaret (Hirlinger), '85; they have two kids, Alan and Jeffrey, and live in Palo Alto. . . . **Nancy Defeo** reports that world traveler **Laura Lesniewski** will finish a master of architecture degree at Berkeley and then will travel and study in Europe, and will visit Brazil, Egypt and Poland; after that her plans are up in the air. Nancy bought herself a condo in Stoneham and works at TASC

on stuff she cannot talk about. She also reports that **Deedee Yoshimura** works at GE in Schenectady.

**Lou Jandura** is at JPL and enjoys it. . . . **Suresh Subramanian** works at Bellcore and just bought a townhouse in New Jersey. Pamela and **Kevin Soch** now have a third child, Elisha Rose. Kevin will finish an MBA at UCSD this year. **Malcolm Delaney** visited them recently; he is finishing his PhD in Illinois. . . . **Leif LaWhite** spent the better part of July biking around Glacier National Park, Banff, Jasper, and Vancouver. . . . I finally graduated, took a little time off, vacationed in California and started at MITRE in mid-July. I recently saw **Gil** and **Linna Ettinger** out in California and on their trip to Boston for the artificial intelligence conference. Their daughter Alyssa is too cute for words, and Gil is starting to look good in baby drool.—**Howard Reubenstein,** secretary, 38 Belknap St., Somerville, MA 02144, (617) 625-9299, hbr@mitre.org

# 85

Greetings everyone! I am very excited to be your new class secretary, and I hope that as many of you as possible will take some time drop me a line in the near future.

**Lora Silverman** was married to Keith Stolzenbach ('66) at the Hotel Bel-Air in Los Angeles. Lora will soon be completing her law degree at Loyola. Among those attending the wedding were **Shelly Johnson, Rodney Schmidt, Jill Tobin, Todd Tsakaris, Andy Wescoat,** and his wife Hee-Jung (Ko) ('87), and Rita Fortiani ('82). Shelly is doing her residency at Tuft's New England Medical Center while thriving on Lean Cuisine Fiesta Chicken dinners. (Make a note of this secret to success in the medical professions.) . . . Rodney is a senior design engineer for Advanced Logic Research in Irvine, Calif. . . . Jill has been attending Dartmouth pursuing an MBA. This summer she is working at a venture-capital firm in the Boston area. . . . Andy now works for Mobil at a refinery in Torrance, Calif., while Hee-Jung is employed by Pfizer's medical instruments division. . . . Rita is obtaining a master's degree at Tufts, where she has moved from waste-water treatment to garbage disposal.

**Albert Wang** and Moon Lee recently had a party at their beautiful condominium in Emeryville, Calif. **Amy Axelrod,** Amy Austin ('87), Mimi Bloon ('87), and Susan Zarzeczny ('87) were there. Mimi will be starting an MBA program at Harvard this fall, while Susan will be going to Cornell for a PhD progam in statistics. . . . Our esteemed class treasurer, **Anita Killian,** now lives in a beautiful apartment in University Park at MIT. Besides single-handedly running the EAPS department at MIT, she is co-authoring a textbook. **Rick** and **Louise (Ettedgui) Miller** were at Anita's recent house-warming party. Rick is a design engineer, and Louise has abandoned mathematics for a career in law.

**Jim Hutchinson** has been spending his summer in California before returning to MIT for a PhD program in computer science this fall. . . . **Dave Sherman** still lives in Connecticut and works for Rogers Corp. . . . **Andy Renshaw** has begun his residency in pathology at the Brigham and Women's Hospital. (The women have been evacuated.) . . . **Patrick Chin** writes that he began an opthalmology residency at New York University Medical Center in July. Patrick also has plenty of news about other classmates: **Tom Choi** is starting his opthalmology residency at University of California at Los Angeles Jules Stein Eye Institute. . . . **Brian Carty** graduated from Bowman Gray Medical School and will be doing a family practice residency in Maryland. . . . **Eric Chan** has moved to New Jersey with his wife after graduating from University of Vermont Medical School. He is doing a residency in internal medicine at Overlook Hospital in Summit, N.J., which is coincidentally the hospital where Patrick was born. (Is this evidence of some sort of cosmic unconsciousness or what?) **Steve Pang** is starting law school at George Washington University this fall. Steve's roommate **Ric Carreras** is now working for Bose after deciding not pursue a PhD.

**Ajay Nahata** is doing research at Allied Signal and sharing a house with Daniel Lin ('86). . . . **Celia Lee** writes that she is currently working for Thermo Electron Technologies in Waltham, Mass. Apparently she cannot cut her ties to MIT, for she continues to work out with the Women's Waterpolo Club and to use the MIT weight room. . . . **Justin Ryan** and his wife Peggy report the birth of their first son Mark on January 11, 1990. Justin is a Navy lieutenant who pilots A-6E attack planes from aircraft carriers.

**Chris Furlong** reports that he is quite happy at GE Aircraft Engines in Cincinnati, Ohio because of the abundance of (in ascending order, no doubt) Canadians, MIT grads, and golf in the area. He is planning to marry a woman from Windsor/Toronto on November 10, 1990. . . . **Walter Tucker** and his wife Katie (Wellesley, '87) announce the birth of their daughter, Laura Jean, on April 30, 1990. . . . **Arline Yen** has graduated from Southwestern Medical School in Dallas and is now completing her internship in internal medicine at University of California San Diego. **Rich Weaver** took time out from working at the Management System Division at Proctor and Gamble in Cincinnati to marry Linda Stieger on April 24, 1990. Rich answers the question of why he is *still* in Cincinnati by saying, "I like it here 'cuz it's a great place to raise a family."

As for myself, I am still a starving PhD student in mechanical engineering here at University of California Berkeley. Send letters and your generous contribution to the Bill Messner food budget.—**Bill Messner,** secretary, 3320 King St. Apt. A, Berkeley, CA 94703, (415) 420-1959, messner%cmlds6@ucbarpa.berkeley.edu.

# 86

Thanks for all the news. It's great not to have to make stuff up. **Michael Bates** got married last July 22 (I assume 1989) in Fayetteville, Ark., with lots of ZBT brothers in attendance: **Alan Yueh, Dave Russ, Chuck Stern, Jim Reisert,** Jim Haleblian, '87, Ed Arenberg, '85, Kerry Elkins, '85, Sam Levitin, '85, Keith Paquette, '85, John Pflueger, '85, Brad Waller, '85, Marc Zissman, '85, Brett Doehr, '83, Brian Trawinski, '89, Pete Sullivan, '88, and Vic Barocas, '88. Other MIT alumni present included **Melizza Ayuyao** and **Karla Johnson.** Sounds like quite a reunion. Michael is still with Burtek as a senior software engineer, working on a refurbishment of an Air Force training system.

**Robert Bieri** is at Lawrence Livermore National Laboratory trying to finish his thesis for an MIT PhD in fusion energy. . . . **Jeffrey Arenberg** is attending the Haas School of Business at UC/Berkeley where he is production editor of the *Cal Business Weekly.* He worked for the ARCO Investment Management Co. in Los Angeles this summer. . . . **Susan Solomon** graduated from Haas this past June with an MBA. . . . **Frank Verhoorn** was married in September and gained two charming daughters. He met his wife while bicyling at Hewlett-Packard. Frank has been working at InfoChip Systems of Santa Clara since November 1988. InfoChip is a small start-up venture whose first products, data compression hardware, were just announced this past May. . . . **Peggy Moore** married Brad Wargelin, '85, on July 14, 1990, at Wellesley, Mass.

**Michael Davis** recently earned his JD from the University of Houston Law Center. He got married on last August 18 in Houston, with **Jeff Wang** serving as best man. After his honeymoon, Michael moved to Dallas where he will practice intellectual property law (patents, trade secrets, copyrights, etc.) at the law firm of Baker & Botts. Baker & Botts is the oldest and third largest law firm in Texas, having nearly 400 attorneys. Michael will handle matters for several of the firm's clients, including Texas Instruments, Electronic Data Systems, and Sematech. . . . **John Bartholomew** married Kim Foss (Emmanuel '90) on July 21, 1990, his "soul partner" for the last three years. . . . **Mike Straub** was the best man. Ken Steele, '90 and Paul Boutin, '92, were also in the wedding party. John and Kim spent their three-week honeymoon in France, Italy, and Great Britain. John has spent the last two years in Portland, Oreg., working for Mentor Graphics Corp.—a great place to work! They sent John and Kim and all the other engineers and their families to Disneyworld for six days on a company-paid vacation as a break from all the overtime put in for a new software release. Gees, I'm in the wrong business. John is in yet another band—The Reason Why—that's playing in the clubs of Portland. Their recent eight-song tape, *Too Many Brains,* has sold two hundred copies, and they've appeared on local cable. Watch out MTV!

**Lenny Tender** got married June 3, 1990, to a girl from **Alan Hildebrand**'s medical school class at Yale. **Anthony Scotti,** Maria Kozloski, '87, and Catherine Cherubino, '88, attended. Lenny is pursuing a PhD in chemistry at UNC. Congratulations! Alan graduated from Yale Medical School and has begun residency in orthopaedic surgery at the University of Michigan. . . . **Brian Miller** was sighted on the Stanford campus in close proximity to Mikhail Gorbachov. . . . **Steve Brandwein** has also finished medical school and has begun residency in internal medicine at Boston University.

Lt. **Vic Christensen** writes in from Right Pitiful (I mean, Wright-Paterson AFB, Ohio). He is the ASD TEMPEST manager. He's gotten to work with the F-15, F-16, B-2, Advanced Cruise Missile, NASP, and the Advanced Tactical Fighter. He has since moved to a new job in the ATF Spo, where he'll be designing a network for them. He and Teri Centner, '89, hosted Air Force ROTC cadet Jackie Moore, '92, for Hospitality Night. Vic thinks Andy Bourget, '89, Dan Bullock, '84, and **Andy Solem** are also at Wright-Pat, but he's only actually seen Andy Bourget. Finally, Vic's been trying to get back into playing tennis and bicycling, but when it's 80-90 degrees and 70 percent humidity, it's really hard.

I pinned on "captain" August 16. I managed to maintain a pulse for four years, so the Air Force thinks I'm ready for more responsibility. At least the pay raise will be nice. Thanks again for the info.—**Mary C. Engebreth,** secretary, 1800 Hermosa Ave., Apt. A, Hermosa Beach, CA 90254

# 87

And now for the latest information, sent directly to the *Review* office: **Ajay Bhardwaj** is attending the University of Chicago in pursuit of an MBA; **Corey Kerstetter** is working for GTE in Stamford, Conn.; and an unnamed member of the class (because he didn't put his name on the information sheet) is back in the States after spending two years at Cambridge University in England. He or she is currently doing grad work in experimental solid state physics at Cornell. Please identify yourself.

I also got some information through my own mails. The first letter comes from **Rocky Moy.** Rocky is stationed (active duty, Army) near Karlsruhe, West Germany, 50 kilometers south of Heidelberg and 20 kilometers east of France, on the east bank of the Rhine. He writes: "As a starting point for traveling, it's ideally located; I've visited France, Spain, Britain, Holland, the Netherlands, and Switzerland so far. Being separated from my family and most of my friends isn't much fun, but there are some advantages. I'd like to think that living here has helped me grow up a little: I have learned to be more humble (not being able to speak German here makes you feel stupid in a hurry) and more practical (hint: don't ever forget about perishables in the refrigerator). Whenever things get too messed up to deal with, I can always get in my car and take

my frustrations out on the Autobahn. Anyway, my current job is as the personnel officer for the 78th Engineer Battalion, although I've passed most of my tour as a platoon leader."

Rocky has gotten together with Mark Metz (Course II, '89) and **Chuck Davis** (Course I). Mark lives about 20 minutes from Rocky but is spending the summer at his construction site. Chuck lives near Frankfurt, about two hours away. Rocky invited Chuck to go to Berlin "to chip at the Wall and see the East-Berliners get freedom-happy." Chuck said he didn't have time because he had to tool. Old habits die hard, I guess. By the way, if anyone is interested in a piece of the Wall, Rocky picked some out himself.

**Eric Esterling** wrote in with quite a bit of news: "**Andy Sterbenz** is at Fort Leonard Wood in the center of Missouri, where he is playing hotel manager/homeroom teacher at the Army's advanced Individual Training Center. . . . Eric went to California to visit **Paul Kwait, Laura Finkelstein,** Terry Donahue, '89, and **Rick Cardenas.** Paul is at the University of California, Berkeley, where he is playing with lasers as a budding physicist. He survived the earthquake completely intact. Laura is working for Sun in marketing. Terry is working for Next, and Ricky is working for Oracle.

**Dave Modiano** is a grad student at MIT in aero/astro. He got to spend the summer living and working in Sweden.

Since graduation, Eric has been working in Providence, R.I., for Cadre Technologies, a software company. He also got to spend his summer in Europe on an "extended business trip." He was based in Geneva, Switzerland, but had the opportunity to travel to eight other countries, including Finland. He even managed to meet Dave in Stockholm.

Eric had some information on other Random 2nd's: Jan Kreuger, '85, and Bernie Gunther, '85, got married last spring and are living and working in Cambridge. . . . Jim Brody, '89, is attending Princeton, where he is another budding physicist.

Special thanks go to **Steve Kardon** who managed to send me some e-mail. . . . Several members of our class gathered in Minneapolis for the April 28 wedding of **Bill Wegerer** and Susan Dittmar. Bill has been working at Honeywell since graduation. His bride is a fellow Honeywell employee. Best man, Rodney Hess, '89, currently works for Codex in Canton, Mass. Groomsmen **John Kwon** and **Steve Kardon** are also Honeywell employees. Steve recently received his MBA from the Carlson School of Management, University of Minnesota. Also in attendance at the wedding were **Gus Lopez, John Nguyen, Bob Durie, Sumanth "Sam" Kaushik, Tony Mercado,** Todd Barber, '88, Ezra Peisach, '89, Mike Truog, '89, Tricia Wilson, '90, and Curtis Hedman, '66.

Since graduation, Gus has completed a master's in computer science at Brown University and worked as a systems engineer at AT&T Bell Laboratories. He is currently living in Seattle and pursuing a PhD in computer science at the University of Washington. . . . **John Nguyen** is a graduate student at MIT working on his PhD in computer science. . . . **Sam Kaushik** is a graduate student at MIT working on his PhD in electrical engineering. . . . **Bob Durie,** after working at Honeywell, is now working on his PhD in electrical engineering at Cornell University. . . . **Tony Mercado** received his master's in computer science at Brown, and is currently working for Bell Labs in New Jersey. . . . Todd Barber is working on his master's in aero/astro at MIT. . . . Al Fullerton is working on his Master's in Electrical Engineering at Brown. . . . Ezra Peisach is working at MIT as a Project Athena employee. . . . Mike Truog is working at Honeywell. . . . Curt Hedman is manager of SADARM Systems at Honeywell.

That's all for now. Thanks for all the help and please keep it coming! Write, call or e-mail!—**Stephanie Levin,** secretary, Apartment 8B, 393 West End Ave., New York, NY 10024, (212) 595-3172 or dKennedy@oracle.com.

# 88

Happy Holidays! This month's a real quickie. **David Hamilton** finished a nine-month internship at *The New Republic* in D.C. last June. He is now working for *Science* as a reporter with the "News and Comment" section. One of his responsibilities is part-time editing of the "Briefings" section, a collection of news notes from the world of science and technology. He encourages you to write of interesting cutting-edge research in which you may be engaging. His address is 1333 H Street, N.W., Washington, DC 20005

**Christine McIntyre** vacationed in northern Michigan and San Francisco this summer. While in California, she saw **Karin Hollerbach** and visited Alcatraz island, Ghiradelli Square, and Lake Tahoe. After all her vacationing, she started her internal medicine rotations at the end of July.

**George Huang** took the summer off to do research in a lab back at MIT. He is working on his thesis for the HST program at Harvard Med. He also spent some time at home in California at the end of June. George started rotations in September.

As for me, I also started on the wards in September, beginning with medicine. Since at the time of this writing, I have not yet begun my rotations, I can only relay apprehensiveness. How are all of you doing in your respective careers? Hope to hear from more of you soon! New Address: **Grace Ma,** secretary, 545 East 1st Ave., 9H, New York, NY 10016, (212) 545-7950

# 89

**Prashant K. Singh** joins the GE Research and Development Center as a physicist on the Edison Engineering Program in Schenectady, N.Y. . . . **Lindsay Wagner** is in Japan, skiing on the cross-country ski team at Kyoto University. . . . **Mark Lim** is also in Japan, studying in the astrophysics lab at Nagoya University. Mark does akido on the side.

**Rick Franklin, BJ Bergevin, Chris Doerr,** and **Kyle Robinson** work hard at Williams AFB in Phoenix, Ariz., learning how to fly. All four of them soloed in T-37s at the end of July and probably will fly T-38s by the end of October. Rick says that it is a lot of hard work, but "it sure beats Course VI problem sets." I also heard from BJ, who reports that the four of them have been burning up the books—just like being back on campus. BJ will be there until next May, and will not miss Cambridge winters at all; the usual summer temperature is 110.

**Sam Hou** toured Taiwan with a large group of people from all over the United States, including **Rebecca Kao, Victor Lau,** and **Cathy Su.** While visiting museums, memorials, and nightclubs, Sam ran into **Joe Tang** and **Adam Kao.** . . . **David Forbes** writes from the Hill School in Pottstown, Pa., where he finished his first year teaching calculus and computer courses while helping to coach water polo and hockey. The faculty at the Hill School receive country club memberships, maid and laundry service; "quite a posh environment," reports David. Visiting David in February was **John Allen.** After trekking to Atlantic City, they topped off the weekend skiing at Blue Mountain, Pa. John was in Japan with Nissan, and returned to MIT to finish up a master's degree. Dave also traveled to Houston, where he saw **Amy Meyers** at a "great hot tub party."

**Mike Paryuchowski** married Halina Minkevich, '90, outside of St. Louis in January. **Chris Peck** was in attendance. . . . **Tali Tamir** is at Boston University management school. . . . **Lisa Robinson** works for a paper company in Maine. . . . **Julie Shreeve** is working on a master's degree in chemistry at UC Irvine.

**Catherine Rocchio** works at BBN in Cambridge. She was assistant coach of the women's gymnastic team last year, and hopes to continue this year. Catherine attended the June 2 wedding of **Krista Beed** and Craig Pastrone, '90. Also there were **Maya Bose, Jennifer Felch, Karen Gold, Jennifer Lloyd, Carolyn Zehner, Michelle Sequetia, Amy Austria, Eileen Murphy, Nancy Kim,** and **Ed Kim.** Maya spent a semester studying in Florence, Italy; Catherine visited and had an awesome time. Maya attends chiropractic college. Eileen is engaged to John Zink, '88, and will be married in October.

**Anu Vedantaham** works at Bellcore in New Jersey. . . . **Leslie Lin** was married in June. . . . **Liann Wong** works for Varian in San Francisco. . . . **Amy Lim** spent the summer working for Bell Labs, and started a PhD in computer science at Stanford. . . . **Lori Tsurada** and **Jonathan Monsarrat** were married on July 28. . . . At UPenn studying neuroscience is **Sam Peretz.** While working on his PhD, he is also pursuing an MS in computer science. . . . **Jon Maltzman** is also at Penn, finishing his first year of medical school. Jon is in the MD/PhD program (PhD in immunology), and keeps himself more than adequately occupied.

**Pratina Rangarajan** is at Princeton studying for a PhD in chemistry. . . . **Deborah Kuchnir** is also at Princeton, working on a PhD in physics. . . . **Yoel Weiss** works in New Jersey, but does a lot of business travel, including a trip to Hawaii. While in the Philadelphia area, he met up with Pratina, Sam, and **Michael Gobler,** who now works in Cambridge. Also, **Rich Berg** ran into them while on his way from D.C. to Pittsburgh. . . . **Mark Kantrowitz** is working on his PhD in computer science at Carnegie-Mellon University. Mark recently got an NSF Fellowship and does research on natural language generation for the OZ Project, an interactive-fiction system.

I managed to sneak out to California before the summer was over. While there I saw **Jason Nieh** and Angela Wiley, '91. Jason finished his MSEE in June and spent the summer working on high-performance computing systems. I don't know how Jason manages to get any work done with the fabulous weather they have all the time. The thing that struck me most, however, was the abundance of life in the bay and along the shore. Everything from sea lions to pelicans to hummingbirds; such contrast to living along the Charles for four years.—**Henry Houh,** secretary, 14 St. Paul St., No. 1, Cambridge, MA 02139, tripleh@athena.mit.edu

# 90

**Brent Backhaus** will be presenting his thesis at a professional conference in Orlando, Fla. His thesis, which deals with an actively correctible mirror for use in a space-based laser radar system, will also be published in *Optical Engineering.* Brent is a product engineer at John Deere & Co. in Iowa. . . . In June there was an engagement party in Dix Hills, N.Y. for **Nicole Skinner** and **Arthur Lent.** At the party, I spotted **Meryl Alford, Lori Brown, Sandy Serkes,** Derek Chiou, '89, and **David Darmofal,** G. Arthur and Nikki were married in August in Redwood City, Calif. Nikki is studying at Tufts and Arthur is working for a PhD at MIT.

**Desmond Davis** writes that he's been working at McKinsey in Cambridge and looking for a nice place to live. . . . **Steven Shen** spent his summer traveling in Taiwan and Hong Kong. Steve is working for Ford Motor Co. in Michigan. . . . **Chris Fennema** is studying neuropsychology at University of California, San Diego. . . . **Erica Wickstrom** and **Julie Wissink** are both out at Stanford. . . . **Andrea Li** is at the University of Rochester. . . . **Peter Rovelstad** is working in Seattle. . . . **Tami Jacobsen** is a marketing representative at IBM in Long Island. . . . **Debbie Bein** is working at Stanley in Connecticut.—**Ning Peng,** secretary, 10140 Creekwood Cir., Plymouth, MI 48170

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# COURSE NEWS

## I CIVIL ENGINEERING

From Bangkok, Thailand, **John Fayi Elliott,** PhD '69, writes: "I am now chief of the Technology Section at the United Nations Economic and Social Commission for Asia and the Pacific (ESCAP). I direct and manage assistance to member countries in Asia and the Pacific region in setting up policy and institutional infrastructure for science and technology, strengthening technological capabilities of member countries, and monitoring breakthroughs in science and technology. All this is done through consultative meetings, studies, information dissemination, advisory services, etc. I am the current chair of the Staff Council, a member of the Construction Advisory Group, and vice-chair of the appointment and promotion committee of ESCAP. I am also a member of the Society of International Development (SID), and currently 2nd VP of the coordinating committee of the Independent Staff Unions and Associations (CCISUA). . . . **Myron S. Rosenberg,** SM '77, has become VP of Camp Dresser & McKee, Inc. He was formerly an associate at the Boston firm.

**Michael S. Schultz,** SM '81, is now managing principal-in-charge of the engineering group at Dames & Moore of Boston. He recently joined the firm as an associate and is currently working on projects including evaluating leachate treatability work being performed at the Charles George Superfund site in Tynsboro, Mass., and directing the environmental and structural assessment of industrial property in Edison, N.J. Previously he was an associate with SEA Consultants, Inc., in Cambridge. . . . **William P. Brown,** SM '85, is a consultant for the McDonnell Douglas Corp. He was previously president and CEO of McDonnell Douglas Helicopter Company (a subsidiary of McDonnell Douglas Corp.), in Mesa, Ariz. . . . **James Blaney,** SM '77, has been promoted to VP of Project Software & Development, Inc. He had been a manager of product marketing for the Cambridge-based firm. . . . **Cranston R. Rogers,** SM '51, has been appointed VP and director of transportation design at the Massachusetts office of Maguire Group, Inc. He will be responsible for all marketing and administering transportation design services.

## II MECHANICAL ENGINEERING

**J. Lowen Shearer,** ScD '54, professor at Penn State, writes: "I've recently co-written a new undergraduate text entitled *Dynamic Modeling and Control of Engineering Systems* (MacMillan, 1990), with B.T. Kulakowski." . . . **N. Richard Dunteman,** SM '70, reports: "I was transferred from London, Ontario, back to LaGrange, Ill. I am director of the Engine Business Electro-Motive Division at General Motors, in charge of all facets of



*Richard R. Monsen, '57 (right) is the president of Monsen Engineering, the Fairfield, N.J. company that was named 1990 Commercial Contractor of the Year by* Contracting Business *magazine. The company was founded in 1948 by Monsen's father, whose portrait hangs behind Dick and Dick's son Eric, who's been working his way through all aspects of the family business since he was 12 years old. Monsen Engineering covers commercial and industrial air conditioning and heating, controls, design/build construction, preventive maintainence, and more and has targeted 1990 gross sales at $12 million.*

locomotive diesel engine business including commercial, engineering, and manufacturing." . . . **Chauncey C. Chu,** '48, is executive VP for manufacturing & customer service at Visual Technology, Inc., in Westborough, Mass. He was formerly VP of Wang Laboratories, Inc., in Lowell, Mass.

## III MATERIALS SCIENCE AND ENGINEERING

**A. Craig Hood,** '50, a Fellow of the American Society for Metals (ASM) was recently named Delaware Valley "Metals Man of the Year" by the Liberty Bell Chapter of the Society. The award was presented in "recognition of Hood's accomplishments in the metallurgical field, his ability as an executive in the metals industry, and his untiring and unselfish efforts on behalf of the Chapter, the Society, and the profession." The award, given annually since 1954, is the Chapter's highest honor. Hood is president of ACH Technologies, Inc., of Wayne, Pa., an international consulting firm specializing in mechanical fastening, metallurgy, and technology management. He holds patents in fastener coatings and thread roll tool design, and he is the co-inventor of an alloy of titanium. . . . **William R. Prindle,** ScD '55, associate director of R&D and engineering for Corning, Inc., has been elected a member of the National Academy of Engineering. Prindle was cited for "his outstanding leadership and innovation in the direction of industrial R&D in modern glass and ceramics technology."

**Jerzy C. Kuczynski,** ScD '47, of South Bend, Ind., died on May 16, 1990. He was professor emeritus at the University of Notre Dame in the Department of Materials Science and Engineering at the time of his death.

## IV ARCHITECTURE

**Rod Brana,** SM '85, sends word: "I have been named VP for development at NVRetail, Inc., a Northern-Virginia-based developer of commercial real estate. On July 5, 1989, my wife, Monica Brana, and I had our first baby, Nicholas Alexander Brana." . . . **Marc A. Maxwell,** MAR '85, has been promoted to VP for design at Building Diagnostics, Inc. With the Boston-based firm since 1987, Maxwell "has played an important role in strengthening the company's industry position in facility programming, design review, design management, and post-occupancy facility evaluation for senior housing, hospitals, and office buildings," according to a company press release. . . . **Wayne Andersen,** Course IV professor from 1964-1986, has recently written *My Self* (Fabriart, 1990). The book jacket reads: "[This] is a highly original work combining fragments from the journal of a professor at one of the world's most prestigious institutions, MIT, with personal letters chronicling a spiritual and geographical exile, essays challenging certain principles of art and criticism, science and religion."

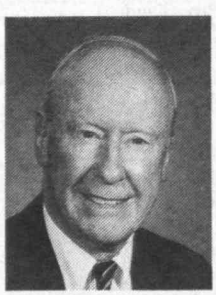
**Woo-Sung Kim,** MAA '72, writes: "I am president of Archi-plan, Inc., in Seoul, Korea. The firm is currently working on leisure-town development projects, commercial and housing new-town projects in Korea. I want to keep in touch with MIT alumni/ae who are interested in Korean projects or experiences." . . . Five Course IV graduates received citations in the 1990 "Progressive Architecture" awards program. **Victor Olgyay,** MAR '86, **Ellen Katz,** '78, Daphne Politis, MCP '85, **Gayle Epp,** MCP '75, and **Chris Pilkington,** MCP '85, won awards for their work on two projects: *Design for Access* & the *Access Improvements Workbook,* and *Quincy Mental Health Center Post-Occupancy Evaluation.* The awards were given in recognition of innovative architecture.

**Vito P. Battista,** MAR '36, of Brooklyn, N.Y., died on May 24, 1990. An architect and planner, Battista founded and directed the Institute of Design and Construction in downtown Brooklyn in 1947. The School trained more than 30,000 students as architects, engineers, and draftsmen, as well as other construction jobs. He participated in designing the 1939 World's Fair, the Brooklyn Civic Center, the State Supreme Court Building, and many other large public buildings. Battista was also a flamboyant figure on the political scene, running unsuccessfully as an independent candidate for mayor six times between 1957 and 1977. He viewed himself as a spokesman for "the little people" and the "oppressed taxpayer." He often resorted to gimmicks to garner attention such as parading a camel through lower Manhattan in an effort to warn politicians that if they adopted another tax measure its back would break. He railed against welfare, low-income housing, raises for officials, and rent controls. He created the United Taxpayers Party to champion the cause of the small landlord and once inspired a group of landlords to storm City Hall to protest continued controls on apartment rents. Battista was a Republican State Committeeman for 20 years and was a delegate to five national Republican conventions.

**George Nakashima,** MAR '30, of New Hope, Pa., died on June 15, 1990, after a brief illness. He was a master woodworker and designer who sought to capture the noble character of trees in chairs, tables, and cabinetry. Nakashima worked with untrimmed slabs of wood, particularly black walnut and redwood, often leaving natural cracks and holes in the final product. His work appeared in the Museum of Modern Art and many galleries, including Washington's Renwick Gallery, and was featured in periodical publications as well. Nakishima was interned in 1939 on an Idaho farm for being a Japanese-American. While there, he studied with an old Japanese carpenter who managed to have him released. Nakashima moved to New Hope in 1945 and started a furniture business with only $100. Most of his work was made to order and although he did not frown on the use of machinery, he did most of the delicate shaping and finishing by hand. Last summer, the American Craft Museum in New York staged a major retrospective of his work.



*A.C. Hood*



*W.R. Prindle*



*M.A. Maxwell*


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# A Burgeoning Specialty



Back in 1986, Roger Reiss,'55 saw the need for professional exchange among mechanical engineers working in the area of "precision instrument design," a field that bridges the traditional disciplines of mechanics, optics, and electronics.

So he launched two initiatives, the continuing success of which has vindicated his vision: a regular column on precision instrument design in *OE Reports*, a publication of the international Society of Photo-Optical Instrumentation Engineers (SPIE), and the SPIE Working Group on Optomechanical and Precision Instrument Design.

In its three years in print, the column has developed an estimated readership of 100,000 worldwide, while the working group has some 750 members and sponsors a number of well-attended professional meetings every year. Reiss, who is currently senior staff engineer for Lockheed Missiles and Space Co. in Palo Alto, Calif., thinks that an important effect of the developing professional identity of precision instrument designers has been the increasing awareness of the value of their work to other engineering disciplines. □

## V CHEMISTRY

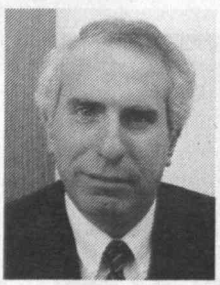
**Donald R. Mattison,** SM '68, currently professor of obstetrics and gynecology and professor of toxicology at the University of Arkansas for Medical Sciences, has been appointed dean of the University of Pittsburgh Graduate School of Public Health. Mattison's expertise is in pharmacology and toxicology, with his research focus being reproductive and developmental toxicology and risk assessment methodology. . . . **William R. Moomaw,** PhD '65, has become director of the Center for Environmental Management at Tufts University in Medford, Mass. Moomaw was previously Fitch Professor of Chemistry and director of the Center for Environmental Studies at Williams College in Williamstown, Mass. . . . **Ioannis Papayannopoulos,** PhD '87, has joined the ranks of the permanent staff as a research scientist in the MIT lab of **Klaus Biemann,** a Course V professor.

**Alfred J. Diefenderfer,** PhD '61, of Fullerton, Calif., died on November 16, 1989. At the time of his death he was dean of the School of Natural Science and Mathematics at California State University at Fullerton, a position he had held since 1978. He joined the chemistry department at Lehigh University after graduating from MIT, leaving in 1973 to join Old Dominion University as chair of the Department of Chemical Sciences and professor of chemistry. Diefenderfer then went on to Cal State. . . . The Alumni/ae Association has been notified that **George T. Weed,** SM '32, of Honolulu, Hawaii, died on January 6, 1990. No further details were available.

## VI ELECTRICAL ENGINEERING AND COMPUTER SCIENCE

**Norman Bristol, Jr.,** SM '83, writes: "I am pursuing a semi-professional tennis career and playing bass in an experimental big band called The A-vocates and an avant-garde band called Left of Center." . . . **Thomas J. Lynch,** SM '59, sends word: "I am a senior scientist with the Washington, D.C., office of Hughes, a space & communications group." . . . **Arthur L. Pike,** EE '54, retired last August after teaching in the Department of Electrical Engineering at Tufts University for 36 years. . . . **Charles A. Zraket,** EE '53, the former CEO and president of Mitre Corp., has been named a director of Wyman-Gordon Co. in Worcester, Mass. . . . **William E. Leonhard,** EE '40, has retired as chair and CEO at The Parsons Corp. in Pasadena, Calif. . . . **Steven D. Litvintchouk,** SM '78, has been promoted to principal engineer in Division D70, Information Systems at the Mitre Corp. According to a company newsletter, he is "especially knowledgeable and experienced in Ada, artificial intelligence, and software development methodology and prototyping."

**Robert J. Shillman,** PhD '74, president and CEO of Cognex Corporation in Needham, Mass., has been named New England's 1990 "Entrepreneur of the Year" in High Technology by *Inc.* magazine, Ernst & Young's Entrepreneurial Services Division, and Merrill Lynch. According to a Cognex press release, Shillman "was chosen



*R.J. Shillman*

from more than 150 New England entrepreneurs for his company's success in the field of machine vision—computers that can 'see.' The company began by selling and installing custom vision systems to end users and has evolved into developing and selling standard 'vision engines' for system integrators and large OEMs to adapt to their own products, thus eliminating the need for substantial service and support." . . . MIT has received a grant of $4,000 under the GTE Corp.'s Lectureship Program in Science, Technology, and Human Values. Under the grant, MIT will present a public lecture and seminar series entitled: Ethics, Technology, and Public Policy. **Jerold T. McClure,** SM '63, manager of business acquisition and planning at GTE Government Systems Corp., Command, Control, and Communications Systems Sector, presented the award to Ken Keniston, MIT's director of the Program in Science, Technology, and Society.

**Herbert H. Woodson,** '51, dean of the College of Engineering at the University of Texas at Austin, has been given the National Society of Professional Engineers' highest award to an individual: the NSPE Award. Woodson founded the MIT Electric Power Systems Engineering Lab in 1967 and served as its director until 1971, when the University of Texas at Austin recruited him to be chair of their electrical engineering department. Under Woodson's leadership for the next ten years, department enrollment more than doubled, and electrical engineering at the University moved from a national ranking of 17th to 13th. During the energy crisis of 1973, Woodson created and directed the University of Texas Center for Energy Studies. Since then more than 400 energy research projects have been conducted. Woodson also founded the Center for Fusion Engineering in 1982 and he cofounded the internationally recognized Center for Electromechanics in 1977. This center has become a pioneer in the development of pulsed rotating generators and electromagnetic accelerators. Over the past 33 years, Woodson's research has resulted in five U.S. patents, and more than 140 research publications. The primary focus of his research is applied magnetics, electromagnetics, and electromechanics. . .

The National Science Foundation has selected **Norman F. Sheppard, Jr.,** '78, assistant professor of biomedical engineering at The Johns Hopkins University School of Medicine, as a 1990 Presidential Young Investigator. Recognized for his work with biosensors, Sheppard is developing a glucose sensor that someday may be used to control insulin pumps implanted in diabetics in place of daily insulin injections.

**Russell E. Long,** '54, of Holbrook, Mass., died on May 22, 1990. He was general manager of the test equipment division of Dynamics Research Corp. in Andover, Mass. Long was a registered professional engineer and worked 15 years for Dynamics Research. He was a member of the engineering honor societies Tau Beta Pi and Etta Kappa Nu. A World War II Army veteran, he was

1914-1990

## Howard McMahon
### *Inventor, Research Chemist*



Howard O. McMahon, PhD'41, a physical chemist, inventor, and former president of the Cambridge consulting firm Arthur D. Little, Inc., died of heart disease August 5. He was 75 and lived in Cambridge.

During his 34 years at ADL, McMahon developed many patented inventions, most of them in the field of cryogenics. Perhaps his best-known invention is the Collins helium cryostat, a device for liquefying helium gas at a temperature of 452 degrees below zero Fahrenheit. Developed together with the late Samuel C. Collins, professor of mechanical engineering at MIT, the cryostat made possible new research in low-temperature physics. The Franklin Institute awarded him the Edward Longstreth Medal in 1951 for this work.

McMahon served as president of Arthur D. Little from 1964 until his retirement in 1977, the year that he founded the Helix Technology Corporation. Begun as an ADL spin-off, Helix Technology has grown to become the leading manufacturer of the cryogenic vacuum pumps used to manufacture integrated circuits. McMahon served as a director of Helix from 1977 until his death.

In 1988, Helix Technology established the Howard O. McMahon Fund, an endowed fellowship for physical chemistry students at MIT.

Frank Gabron, an MIT sustaining fellow and chairman of the board of Helix, worked with McMahon at both Arthur D. Little and Helix. He called his friend "a very humble man with a great scientific mind.

"He was unique in that although his education was scientific in nature, he was an outstanding manager and people-person. He was a visionary in both technical and management realms," Gabron said.

McMahon was born in Alberta, Canada and received a BA and MA from the University of British Columbia. While still an undergraduate, his design for bubbling Christmas tree lights earned him the first of his 22 patents. Among his others: a heated mattress and more efficient chemical processing for photography. □


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a member of the William B. Dalton American Legion Post. . . . **Barton L. Weller,** '40, of Easton, Conn., died suddenly on May 25, 1990, following a fall from a ladder as he inspected a home being built for him in Nova Scotia. Weller was the noted industrialist, inventor, founder, and retired chair of Vitramon, Inc., a company that manufactured electronic components. Under his direction, Vitramon expanded until it had six plants in five countries. Weller was a member of the board of directors of the Barnum Festival and served as the 1983 Ringmaster. He held 14 patents for electronic components and two for the Weller World Watch, which simultaneously displays the time for all international time zones.

### VI-A INTERNSHIP PROGRAM

"The lazy, hazy days of summer" are upon us as I write, this first of August. Boston has managed to escape the blistering heat which has plagued parts of the south and southwestern U.S. Just the "humditty" (as they say in Maine) has bothered us for a while. The office is quiet, what with staff vacations and company visitations, and the VI-A students are away toiling mightily at their diverse summer assignments.

It is with sadness that I report another death in the Department, that of Professor (Emeritus) **Joseph C. R. Licklider** on June 26th at age 75. He had a great deal to do with the computer concepts of timesharing and was director of MIT's Project MAC, 1968-70, which later became our present Laboratory for Computer Science.

It is with pleasure that I report the appointment of Professor **David H. Staelin,** ScD '65, as assistant director of Lincoln Laboratory. Dave has long served the VI-A Program as a faculty advisor, initially to the G.E. Co. facility in Pittsfield, but currently to COMSAT Labs in Washington, D.C. He will divide his time between the EECS Department and Lincoln and we wish him well in this expanded endeavor.

While acknowledging service as a VI-A Faculty Advisor, let me also thank a VI-A company coordinator, who has stepped down, who helped me a great deal during my directorship. **Stephen N. Zilles,** EE '70, of IBM's Almaden Labs in San Jose, Calif., has turned over the reins to another VI-A'r, **Dean S. Daniels,** SM '82, whom we officially welcome now, even though he has already been serving. Other VI-A's who have done eminently well at IBM include **Dean E. Eastman,** PhD '65, **Juri Matisoo,** SM '60, (who is director of the Almaden Lab), **Jack L. Rosenfeld,** ScD '61, and **Shmouel (Sam) Winograd,** SM '59, recollecting a few.

An interesting letter was received from **John R.M. Alger,** SM '50, whose grandfather was Professor **Dugald C. Jackson,** SM '22, father and founder of "Course VI-A" at MIT. I forwarded to him the historical article on VI-A by W. Bernard Carlson which I had mentioned in a previous issue of *Tech Review.* That certainly takes us back to the foundations of VI-A!

A VI-A graduate student is one of two winners of 1990 Japan Program Prizes awarded by our Center for International Studies' MIT Japan Program. The award to **Alberto Moel,** EE '90, funded by the Japan-U.S. Friendship Commission, will allow him to attend a professional meeting in Japan during the coming year. "Moel" is working under Professor Henry I. Smith in our Microsystems Technology Laboratory.

Of a more personal nature, a letter from **John F. Cooper** SM '76, tells of attending his 20th high school reunion in Los Angeles this summer. **Edward C. Giaimo** SM '75, became the proud father of a baby girl on the eighth of July. **Lynn M. Roylance,** '72, and **J. Payne Freret, Jr.,** '68, had a second daughter born this past April.

Visiting us in the VI-A Office was **Dean R. Collins,** SM '59, of Texas Instruments, Dallas, who was here for the project review sessions of the Microsystems Center, of which TI is a sponsor. Also, **Kenneth W. Conradt,** SM '87, in investment banking with Merrill Lynch at their World Financial Center in New York City, was in Boston for a weekend of windsurfing on the Charles.—John A. Tucker, Director (Emeritus) VI-A Internship Program & Lecturer, MIT, Rm 38-473, Cambridge, MA 02139.

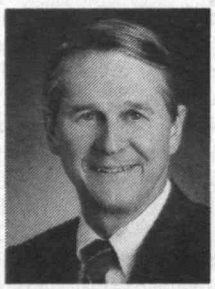
## VII BIOLOGY

**Ronald H. Reeder,** PhD '65, of the Hutchinson Cancer Center in Seattle and Ingrid Grummt of the University of Wurzburg in West Germany made a presentation at the international conference on the Molecular Mechanisms of Cellular Growth held last June in Danville, Pa. The conference participants presented 31 scientific papers and exhibited 47 posters on research in progress. The *Journal of Molecular and Cellular Biochemistry* is scheduled to publish proceedings in the spring of 1991. Reeder and Grummt presented data on the control of the formation of the ribosome that is responsible for forming all proteins. The factors they identified control the formation of the gene that regulates the growth of major organs. Identifying those factors creates the potential for controlling hypertrophy, or enlargement, of the heart and other organs.

## VIII PHYSICS

On June 13, 1990, **Robert M. White,** '60, was sworn in as the first under secretary of commerce for technology by Secretary Robert Mosbacher. In that position, White will be responsible for the new Technology Administration which includes the National Institute of Standards and Technology (formerly the National Bureau of Standards), the Office of Technology Policy, and the National Technical Information Service. This new agency was created by the Trade Act of 1988 to become the focal point of government efforts to assist American industry in improving its competitiveness. . . . **Bruce R. Silver,** PhD '77, is director of Image Management Systems for BIS CAP International in Norwell, Mass. . . . The American Nuclear Society (ANS) has given an award for outstanding contributions of service and leadership to education in the field of nuclear engineering to **Herbert Goldstein,** PhD '43, a professor in the Department of Applied Physics and Nuclear Engineering at Columbia University. Called the Arthur Holly Compton Award, it includes $1,000 and a certificate to Goldstein inscribed "...for his pioneering research and teaching in radiation transport and shielding; and for his selfless effort to promote public understanding of nuclear power."

The National Academy of Engineering (NAE) has selected **Solomon J. Buchsbaum,** PhD '57, senior VP for technology systems at AT&T Bell Labs, to receive the Arthur M. Bueche Award for "his leadership in promoting mutual understanding concerning science and technology among leaders in universities, industry, and government



*R.M. White*

# The U.S. Coast Guard's New Commandant

Admiral John William Kime, NE '64, became the nineteenth Commandant of the U.S. Coast Guard on May 31. He was nominated for the position while serving as commander, Eleventh Coast Guard District, headquartered in Long Beach, Calif. During that time he also served as the commander of the central California sector of the U.S. Maritime Defense Zone, Pacific, and as coordinator of the Pacific region of the Office of National Drug Control Policy.

Since graduating from the Academy in 1957, Kime has held a wide variety of positions in the Coast Guard. He served as principal U.S. negotiator at the International Maritime Organization in London during the drafting of the IMO Codes for Liquefied Gas Ships, and he was in charge of the structural design of the Coast Guard's Polar Star class icebreakers. From 1982 through 1984 Kime was chief of the Operations Division of the Seventh Coast Guard District in Miami, where he was in charge of day-to-day drug interdiction operations in the Caribbean. In 1986 he became chief of the Office of Marine Safety, Security, and Environmental Protection in Washington, D.C., a combination of two offices he had previously headed. Kime is a registered professional engineer and has been awarded numerous medals, ribbons, and honors. □



and for rendering insightful technical advice to five U.S. presidents." Recently named to the President's Council of Advisors on Science and Technology, Buchsbaum has also served on the White House Science Council, the Defense Science Board, the Energy Research Advisory Board, the President's Science Advisory Committee, and several others. He frequently provides expert testimony to congressional commmittees on such recent subjects as the role of American corporations in supplying HDTV systems, research in high-temperature superconducting materials, and the health of the semiconductor industry in the United States.

## IX BRAIN AND COGNITIVE SCIENCES

**Daniel N. Osheron,** Course IX professor, has contribued a chapter to *Computational Neuroscience* (MIT Press, 1990). The book, edited by Eric L. Schwartz, contains 30 original contributions by leading researchers who provide a working definition of "computational neuroscience" as the area in which problems lie simultaneously within computer science and neuroscience. According to the bookjacket, "they review this emerging field in historical and philosphical overviews and in stimulating summaries of recent results, addressing the structure of the brain and the computational problems associated with describing and understanding this structure at the synaptic, neural, map, and system levels." Osherson co-contributed a chapter entitled "Modular Learning."

## X CHEMICAL ENGINEERING

**Arunava Dutta,** ScD '85, writes from Peabody, Mass.: "I was recently promoted to the position of 'engineering specialist' at GTE. I am stationed at the R&D Lab of GTE Electrical Products in Danvers, Mass. My research involves photoluminescent powders and their behavior. My wife, Malini, will be pursuing the doctoral program in chemistry at Boston College in the fall of 1990." . . . **James A. Drobile,** SM '50, has been appointed chair of the new Intellectual Property Law Department of the Philadelphia law firm of Schnader, Harrison, Segal & Lewis. . . . A note from **S.H. Banijamali,** ScD '74, in Calgary, Alberta, Canada says: "MIT graduate school offers more than frontier technology. It offers leadership and capacity to meet challenges in academic, industrial, and even management environments. After graduating I worked with DuPont (USA), Fluor Canada, and currently at Veba Oil Operations in their Process Group." . . . **Charles A. Gray,** PhD '66, has become VP and general manager of the Carbon Black Division at Cabot Corp. in Billerica, Mass. He was formerly technical director of the Industrial Chemical Group at the FMC Corporation in Princeton, N.J.

**Lorenzo Cesar Lamadrid,** SM '74, is the new VP for aerospace marketing and business development at the General Electric Co. in Philadelphia, Pa. He had previously been a staff executive in the company's Fairfield, Conn., office. . . . **Arthur L. Walitt,** SM '65, is now an associate in industrial & environmental affairs for Diane Davis Associates in Boston. He continues as a consultant to the Fiberweb International Corp. in Newton, Mass. . . . **Phillip R. Westmoreland,** PhD '86, a University of Massachusetts chemistry professor, has been named a Presidential Young Investigator by the National Science Foundation. The award is an honor that carries with it funding of up to $100,000 a year for five years. Westmoreland was cited by the foundation for his work in microchip production and in understanding how pollutants form in flame combustion.

**Stanley A. Murray,** SM '49, of Kingsport, Tenn., died on April 11, 1990. He was a founding member and the director emeritus of Southern Appalachian Highlands Conservancy and chair of the Appalachian Trail Conference from 1961 to 1975. Murray worked for Tennessee Eastman Co. until he retired in 1986 to work full time for the Conservancy. . . . The Alumni/ae Association has been notified that **Joseph A. Serrallach,** '34, who was last listed living in Barcelona, Spain, died in December 1989. No further details were provided.


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## XI URBAN STUDIES AND PLANNING

**Tomasz Sudra,** PhD '76, writes from Kenya: "I am continuing as chief of the Training Unit at the United Nations Centre for Human Settlements in Nairobi. Our main training programs this year are Training of Trainers (TOT) courses in urban management and finance in Anglophone and Francophone Africa, Arab states, and Latin America; and housing strategy seminars in North Africa and Southeast Asia." . . . **Allen Adelman,** MCP '88, is now project manager of the Waterworks Division at the Massachusetts Water Resources Authority (MWRA) in Boston. Adelman had been a water supply program liaison for the MWRA Advisory Board. . . . **Joseph W. Chow,** MCP '81, has become VP of the State Street Bank & Trust Co., in Boston. He had been VP for high tech lending at the Bank of Boston. . . . **Hazel Bright,** MCP '80, has retired as dean of student development at Roxbury Community College in Roxbury, Mass. . . . **William W. Harris,** PhD '77, the founder of KidsPac, a political action committee working on behalf of children, has been elected to a six-year term as a charter member of the board of trustees at Wesleyan University.

*Boston Business Journal* ran a long piece on the director of the Port of Boston, **Anne D. Aylward,** MCP '75. In the article she discusses with excitement the unfinished work she sees before her with the Third Harbor Tunnel project. Labor relations have been smooth running during her six-year tenure even in the face of shrinking demand for longshoreman labor. Although 14 years ago she saw working for Massport as a good first planning job before she moved on, she has managed to stay and has a vision for the next ten years. Aylward and the port director of New York City are the only two women currently to hold that position. . . . Five Course IV graduates received citations in the 1990 "Progressive Architecture" awards program. **Victor Olgyay,** MAR '86, **Ellen Katz,** '78, Daphne Politis, MCP '85, **Gayle Epp,** MCP '75, and **Chris Pilkington,** MCP '85, won awards for their work on two projects: *Design for Access & Access Improvements Workbook,* and *Quincy Mental Health Center Post-Occupancy Evaluation.* The awards were given in recognition of innovative architecture.

## XII EARTH, ATMOSPHERIC, AND PLANETARY SCIENCES

**Michael H. Mellen,** SM '84, sends word from Houston, Tex.: "Since leaving MIT, I have held a number of geophysical positions within Marathon Oil Co. I am currently an explorationist in Marathon's Europe/Africa Exploration Special Projects Group. I am responsible for many of the geophysical data acquisition, processing, and technical projects within this region. While based in Houston, much of my time is spent traveling in the company's East African and Middle Eastern petroleum concessions. The remoteness of these areas puts quite the adventurous twist on my work, which I find intriguing." . . .*The New Solar System, Third Edition* (Sky Publishing Corporation, 1990), edited by J. Kelly Beatty and Andrew Chaikin, contains two chapters by MIT alumni. **Clark R. Chapman,** PhD '72, a research scientist at the Planetary Science Institute, a division of Science Applications International Corp. in Tucson, Az., contributed Chapter 18: Asteroids. **John A. Wood,** PhD '58, on the research staff at the Smithsonian Astrophysical Observatory in Cambridge, contributed Chapter 19: Meteorites.

**Karen L. Von Damm,** PhD '84, a research staff member in the Environmental Sciences Division at the Oak Ridge National Lab (ORNL), has been appointed by the Joint Oceanographic Institutions for Deep Earth Sampling Planning Committee to the East Pacific Rise Detailed Planning Group to study hydrothermal systems and their influence on the oceanic crust through drilling. At ORNL, Von Damm's responsibilities are to study water-rock interaction chemistry by looking at groundwater and sediments and observing how they react and what they transport. Recently, Von Damm joined the University of Tennessee faculty as an adjunct associate professor in the Department of Geological Sciences.

## XIII OCEAN ENGINEERING

**Geoffrey L. Abbott,** OCE '82, writes: "I was promoted to deputy supervisor of Shore Maintenance Detachment in Cleveland, and am responsible for Coast Guard Civil/Ocean Engineering for 28 states. I received a Coast Guard Achievement Medal in recognition for my work as chief of the Ocean Engineering Section, SMD Cleveland."

**Charles E. Slonim,** NE '52, is now senior VP & sector manager at Analysis & Technology Inc., in Arlington, Va. He was formerly a VP of the firm. . . . Lieutenant Commander **John G. Cooke V,** OCE '89, has assumed command of the research submarine NR-1, the U.S. Navy's only nuclear-powered, deep diving oceanographic research submarine. . . . Navy Rear Admiral **Edward S. McGinley,** NE '70, has been promoted to his present rank while serving at Norfolk Naval Shipyard in Portsmouth, Va. . . . Navy Lieutienant **Kevin M. Adams,** SM '86, has been awarded the Navy Commendation Medal for meritorious service.

The Alumni/ae Association has been notified that Admiral **Walter M. Foster,** SM '40, (Ret.), of Annapolis, Md., died in 1985. There was no further information provided.

## XIV ECONOMICS

Professor **Peter Temin,** PhD '64, who has been associate head of the department at MIT, became head last July. He succeeded Professor **Richard S. Eckaus,** PhD '54.

**Nicholas S. Perna,** PhD '69, has a new title: chief economist for Shawmut National Bank. He will continue as senior VP and chief economist at the Connecticut National Bank in Hartford.

**Philip Friedman,** PhD '72, dean and professor of economics at the Joseph M. Bryan School of Business and Economics at the University of North Carolina at Greensboro, has been named VP for academic affairs and provost of Bentley College, effective last September. Freidman joined the Bryan School in 1984. He previously was at Boston University, where he was MBA program director, associate dean for graduate studies in the School of Management, and chair of the Department of Finance and Economics.

## XV MANAGEMENT

**Paul R. Carpenter,** PhD '84, writes: "My economic consulting firm, Incentives Research, Inc., has moved to downtown Boston from Cambridge. Partners are **Gary Taylor,** SM '78, **Frank Graves,** SM '80, and **Jamie Read,** SM '80,—all Sloan School graduates." . . . **William R. Cowen,** SM '81, is director of the Environmental Technology Project at The Interface Group in Needham, Mass.

**Lawrence A. Hough,** SM '72, is now president and CEO at Sallie Mae in Washington, D.C. He had been executive VP for marketing, services, and systems for the company. . . . **Jerry D. Bailey,** SM '79, is a senior tax attorney in the Latin America/West Africa Division at Texaco Inc., in Coral Gables, Fla. He was previously director of the International Tax Division at R.J.R. Nabisco, Inc., in Atlanta, Ga. . . . **James B. Adelson,** SM '79, is VP for marketing at Xyquest, Inc., in Billerica, Mass. He was formerly VP of Eloquent

Systems Corp. in Manchester, N.H. . . . **William E. Wade, Jr.,** SM '68, assumed the presidency of Arco Oil & Gas Co. last October. Arco Oil is a subsidiary of Atlantic Richfield Co. and Wade will continue as senior VP of the larger company along with his new responsibilities. Previously, he was president of Arco Alaska, also a subsidiary of Atlantic Richfield, in Anchorage, Alaska. He continues to reside in Alaska.

**Ellen C. Siever,** SM '77, is product manager at Greystone Technology Corp. in Woburn, Mass. She was previously on the technical staff at Mitre Corp. in Bedford, Mass. . . . **Peter P. Kozel,** PhD '73, is now a consultant in Boston. He had been senior VP and chief economist at Shawmut National Corp., also in Boston. . . . **Andrew M. Greenspan,** SM '85, has become director of leasing at the Robert Martin Corp. in Elmsford, N.Y. He had previously been a corporate leasing representative for the firm. . . . **Roman M. Lubynsky,** SM '89, is now VP of marketing for Fasfax Corp. in Nashua, N.H. Prior to his promotion, he had been marketing support manager for Fasfax.

### Sloan Fellows

**Richard E. Brackeen,** SM '75, is now chair and chief executive at Fairchild Space & Defense Corp. (a unit of the Matra Group, a Paris-based international company), in Germantown, Md. He had been vice chair and deputy chief executive for the firm. . . . **Daniel S. Carp,** SM '88, has become VP and general manager of the European Region at Eastman Kodak Co. in Rochester, N.Y. He assumes this new position after having held a similar job for the company's Latin American Region. . . . **Hollis L. Caswell, Jr.,** SM '68, is now chair and chief executive at Hypres, Inc., in Elmsford, N.Y. He had been senior VP and president of Unisys Computer Systems Group of the Unisys Corp. in Blue Bell, Pa.

**Philip B. Fletcher,** SM '70, the president and COO of ConAgra, Inc., in Omaha, Neb., has stepped down as president of Quaker Oats Company, a unit of ConAgra, Inc. . . . **Arthur J. Hedge, Jr.,** SM '73, is now VP for environmental affairs at IBM Corp. in Stamford, Conn. He had been VP for real estate & construction for the company.

**Robert A. Nafis,** SM '65, has become senior management consultant for technology at Grumman Corp. in Bethpage, N.Y. His previous position was as president of the Electronics Systems Division at Grumman. . . . **Frederick F. Sommer,** SM '80, is now VP for purchasing and intercompany logistics in the Service Office at Nissan Motor Manufacturing Corp. in Smyrna, Tenn. He was previously the company's VP for human resources. . . . **J. Phillip Samper,** SM '73, has become president and CEO at Kinder-Care Learning Centers, Inc., in Montgomery, Ala. He had retired as vice-chair and executive officer at Eastman Kodak Co. . . . **Carl A. Erikson,** SM '90, has been named a VP of Ohio Power Co. (a subsidiary of American Electric Power Service Corp.) in Canton, Ohio. . . . **H. Robert Sharbaugh,** SM '61, has retired as a director of Carpenter Technology Corp. in Reading, Pa.

**G. Lowell O'Daniel,** SM '53, of Vergennes, Vt., died on May 19, 1990. O'Daniel was employed by Lever Brothers Co. in Hammond, Ind.; Baltimore, Md.; Cambridge and New York for 41 years, retiring in 1978 as VP for production and distribution and a member of the board of directors. He was a member of the Masonic Order and a Rotarian, and was also a member of the Congregational Church of Vergennes, where he served as both a deacon and a trustee. He was an avid golfer and genealogist; and he took great pleasure in helping his son manage a family dairy farm. In recent years, O'Daniel worked in the capacity of corporate accountant and consultant to Vermont Computer Software, Inc. . . . **Federico Guillermo Baptista,** SM '51, of Caracas, Venezuela, died on March 26, 1981. He had been the president of In-

1907-1990

# Klaus Liepmann
## *Father of MIT Music*



Klaus Liepmann, founder and former director of MIT's music department, died July 30 at his home in Westport, Mass. He was 83.

Liepmann joined the Institute in 1947 as the first full-time professor of music and built a thriving department over the next 25 years. He also performed as a solo violinist and appeared as a guest conductor of orchestras in London, Paris, Hamburg, and Munich as well as the Boston Symphony Orchestra, Boston Pops, and the Berlin Philharmonic Chamber Orchestra.

Born in Kiel, Germany, in 1907, Liepmann began playing the violin at age six. In 1933, he fled Germany for the United States after Nazi authorities forbade him from playing works by Mendelssohn in his position as concertmaster of the Berlin University Orchestra.

In 1972, the year he retired from the Institute, student protests against U.S. mine-bombing in North Vietnam drove Liepmann to speak at an MIT faculty meeting for the first and only time. Recalling the turmoil of his youth in Germany and the Nazis' assaults against human and intellectual freedoms, he encouraged the students' uprising. "I feel it our duty as intellectuals and artists to speak up now and to act now," he told his colleagues, who gave him a three-minute standing ovation and voted to suspend classes for two days of "teach-ins" and discussions on the political issues of the times. His speech was reported in the European press.

Among the awards he received are the Institute's Gordon Y Billard Award for distinguished service and the 1975 Eugene McDermott Award, presented by the Council for the Arts, which deemed Liepmann "the father of music at MIT."

Before joining MIT, Liepmann was a member of the music faculty at Yale University from 1939 to 1944.

The music professor welcomed the opportunity to pioneer a new humanities department at the Institute. He once told *Technology Review* that he was cautioned about moving to the Institute because the " 'students will not have enough technique for their music.' I said, if I have to choose between the technique and the spirit, I prefer the latter."

He is the author of *The Language of Music,* a guide for listeners. □

dustrias Venoco CA. . . . The Alumni/ae Association has been notified that **William F. Stuart, Jr.,** SM '55, of Alpharetta, Ga., died on September 14, 1989. There was no additional information provided.

### Senior Executives

**Raymond F. Pettit,** '70, senior VP of The Rockefeller Group, Inc., in New York, has been named a director of M/A-Com, Inc., in Burlington, Mass. . . . **Lloyd E. Reuss,** '71, has assumed the presidency of General Motors Corp. in Detroit, Mich. He had been executive VP of the auto company. . . . **Robert M. Shea,** '62, a consultant at Boston's John Hancock Mutual Life Insurance Company, is now also an associate at Peabody & Brown in Boston.

The Alumni/ae Association has been notified that **David I. Weisblat,** '59, of Galesburg, Mich., died on April 21, 1990. There was no further informtion provided.

### Management of Technology Program

We are very pleased and proud to report the continuing successes of our MOT alumni/ae. Please keep us updated on your activities. We always enjoy hearing from you. **James L. Rogers,** SM '86, was promoted last March to a strategic planning position for mid-range computers with the IBM division that originally sponsored his year at MIT. He and his family are "really enjoying getting reacquainted with their friends in Rochester." He hopes to see everyone in Barcelona in 1992. . . . **Gary J. Dau,** SM '87, was honored recently when the Electric Power Research Institute's Nondestructive Evaluation Center in Charlotte, N.C., was named after him. A senior program manager at EPRI, Dau is credited with conceiving the idea of the Center and making it a reality. For the last 10 years, he oversaw the Center's work to evaluate and improve technology and procedures for power plant component inspection as well as train personnel in their use. **James Chou,** SM '88, became president and CEO of EMMT Systems Corp. last June. In August he was also named chair. His company produces high-reliability products in AC/DC converters, power modules, and handheld transceivers, and is now designing a digital cordless telephone. . . . **Tom Greaves,** SM '89, is now living in Boston with his wife, Debra, who is pursuing her art work in a spacious studio in the Fort Point Channel arts community. . . . In Tokyo, **Taro Hattori,** SM '89, has moved to the geotechnical section in the Taisei Corp.'s design department. His project is the development of design and manufacturing technologies for a geodome, underground multi-purpose dome in urban areas. He is finding it an exciting and difficult process. . . . **Tony Weighous,** SM '89, stopped by the program office last June to say hello and meet our new director. His daughter, Stacy, graduated from high school with a $1,000 scholarship to Western Michigan University.—Jennifer Mapes, Management of Technology Program, MIT Rm. E56-304, Cambridge, MA 02139.

## XVI AERONAUTICS AND ASTRONAUTICS

**John C. Wilson,** '52, received a NASA Exceptional Service Medal last June at the Honor Awards Ceremony at NASA's Langley Research Center in Hampton, Va. He was cited for "exceptional contributions in both leadership and research roles which have created and sustained a world-class program in rotorcraft aerodynamics research for NASA, the DOD, and the aerospace industry." Wilson has worked for the U.S. Army's Aerostructures Directorate at Langley since 1970. In his present position as head of the Rotorcraft Aerodynamics Group, he is responsible for the supervision of analytic and experimental work in helicopter aerodynamics and acoustics, and specializes in the aerodynamics and stability and control of helicopters. . . . **Harry Elias Stephens III,** SM '74, is now president of Dole Packaged Foods Co. (a subsidiary of Castle & Cooke, Inc.) in San Francisco, Calif. He previously was Castle & Cooke's senior VP for planning & business development.

## XVII POLITICAL SCIENCE

**Thomas A. Bryant,** PhD '82, sends word: "I am president of the Canadian Centre for Creative Technology and we have just launched a new program on technology and entrepreneurship for grade 8 & 9 students: 'Monkey Business!'". . . . **Edward R. (Randy) Jayne II,** PhD '69, has become president of McDonnell Douglas Missile Systems Co. in Saint Louis, Mo. He had been VP and general manager of the F-15 Fighter Aircraft Program at the McDonnell Douglas Corp. . . . Navy Captain **Paul R. Brown,** SM '78, has graduated from the Naval War College. During the 10-month course, Brown studied the elements of strategy and policy, defense economics and decision making, and employment of naval forces. . . . *Three-Way Street: Strategic Reciprocity in World Politics* (University of Chicago Press, 1990) is a new book by **Joshua S. Goldstein,** PhD '86, and John R. Freeman. In the book, the authors analyze the complex intersection defined by relations among the United States, the Soviet Union, and China over the past 40 years. Goldstein is associate professor of international relations at the University of Southern California.

## XVIII MATHEMATICS

**M. Ram Murty,** PhD '80, writes from Montreal, Canada: "I was recently promoted to full professor in the Department of Mathematics & Statistics at McGill University and was elected a Fellow of the Royal Society of Canada.". . . **Donald Batchelor,** '68, a theoretical physicist in the Oak Ridge National Lab's Fusion Energy Division, has been named a Fellow of the American Physical Society (APS). Batchelor joined ORNL in 1976 and since 1984 he has served as leader of a group studying the effects of electromagnetic waves on plasma. He is a member of the Oak Ridge Symphony Orchestra, the Oak Ridge Community Band, and the rhythm & blues band Boys' Night Out. . . . **Richard H. Battin,** '45, adjunct professor in MIT's Aero & Astro Department and Draper Lab retiree, has been named an Honorary Fellow of the American Institute of Aeronautics and Astronautics (AIAA). Battin was given the award for "innovative, fundamental contributions to the science and technology of space flight to the Moon and beyond, and for inspired teaching of the astrodynamic arts to a generation of students."

## XX APPLIED BIOLOGICAL SCIENCES

**Felipe M. Vera,** PhD '83, writes: "I am operations manager at a biotechnology company called Enzymologa. Responsibilities include coordination of manufacturing food additives by enzymatic methods and R&D of fermentation technology products. The company is located in Nuevo Leon, Mexico." . . . **Pauline R. Maier,** an historian widely known for her work on the American Revolution, has been selected as the next holder of the William Kenan, Jr. Professorship. The chair,


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established in 1973 by the William R. Kenan, Jr. Charitable Trust, is designated for distinguished scholarship and teaching in the humanities. Maier's major field of scholarship is eighteenth and nineteenth century American political history and Revolutionary politics, particularly the life and politics of Samuel Adams. Her current work focuses on the tradition of 1776 and how it shaped the organization of American socity between the Revolution and the Civil War.

Professor **Wayne O'Neil,** who had been acting head of the Department of Linguistics and Philosophy at MIT, was appointed head succeeding **Richard L. Cartwright.** O'Neil's recent research has concentrated on a grammar of the English of Nicaragua's Atlantic Coast, the uses of linguistics in the science curriculum, and second language acquisition. . . . MIT Professor **Peter C. Perdue** became head of the History Section last July, succeeding **Bruce Mazlish.** Perdue's research has focused on the long-term social and economic development of China from the 16th through 20th centuries. He is fluent in Chinese and Japanese as well as several other Asian and European languages. . . . Professor **Isabelle de Courtivron** has become head of the Foreign Languages and Literatures Section at MIT. De Courtivron, a scholar in French language and literature, is known for her studies of French feminist writers and is the author of a book on French writer Violette Leduc.

## XXII NUCLEAR ENGINEERING

The American Nuclear Society (ANS) has named **Michael L. Corradini,** PhD '79, professor of nuclear engineering and engineering physics at the University of Wisconsin, as the recipient of the 1990 Young Member Engineering Achievement Award. The award includes an engraved certificate and $500. Corradini was also elected a Fellow of the ANS for "pioneering contributions to reactor safety, particularly in molten fuel-coolant interactions including estimation of probabilities of containment failure from vapor explosions, as well as estimating the limits to molten fuel mixing in coolants, modeling hydrogen generation during fuel-coolant interactions, and modeling transient pressure propagation during vapor explosions."

## TPP TECHNOLOGY AND POLICY PROGRAM

**Olimpia Maria E. Hernandez Pena,** SM '84, and Donald Ratner Jones have an addition to their family. Adriana Katerina Olimpia was born on May 10, 1990. . . . **Annette Elton,** SM '90, has recently joined the staff of CADMUS, an environmental consulting company located in Waltham, Mass. . . . **Nancy Gorelick,** SM '82, is working as a staff scientist at Procter & Gamble Co. in Cincinnati, Ohio. . . . **Olivier de Botton,** SM '88, is presently the chief of organization projects at Cartier International in France.—Rene Smith for Richard de Neufville, MIT Rm. E40-252, Cambridge, MA 02139.

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## Deceased

The following deaths have been reported to the Alumni Association since the *Review* last went to press:

**Edward M. Bridge,** '13; 1983.
**Marion R. Hart,** '13; July 2, 1990; Berkeley, Calif.
**Victor C. Brownson,** '14; June 29, 1990; Holland, Mich.
**Osgood W. Holt,** '17; July 17, 1990; Woodland, Calif.
**Dugald W. Campbell,** '19; August 9, 1982; Garden Grove, Calif.
**Howard L. Brooks,** '20; April 14, 1990; Saratoga, Calif.
**Harland A. Gray,** '20; June 21, 1990; Sarasota, Fla.
**Kenneth J. Roman,** '20; July 4, 1990; Boston, Mass.
**Simon W. Freese,** '21; July 27, 1990; Fort Worth, Tex.
**Charles F. McGill,** '21; 1985; New Wilmington, Pa.
**Richard J. Spitz,** '21; January 16, 1989; Longboat Key, Fla.
**Girard B. Troland,** '21; August 5, 1990; Lexington, Mass.
**Edmund O. Cummings,** '23; June 5, 1988; High Point, N.C.
**Edwin J. Heap,** '23; July 15, 1990; Sarasota, Fla.
**Charles M. Mapes,** '23; July 27, 1990; Suffern, N.Y.
**Anton K. Whitaker,** '23; September 15, 1988; Bradenton, Fla.
**Eric R. Brater,** '24; August 28, 1989; Cleveland, Ohio.
**Paul E. Breer,** '25; December 8, 1989; Amsterdam, N.Y.
**Edward H. Ellms,** '25; July 29, 1990; Dexter, Maine.
**Maxon H. King,** '25; June, 1990; Santa Cruz, Calif.
**Russell C. Mader,** '25; April 26, 1990; Chevy Chase, Md.
**Ralph W. Head,** '26; July 8, 1981; Ithaca, N.Y.
**Edward S. Hope,** '26; June 8, 1990; Cleveland, Ohio.
**Elbert L. Ford,** '27; February 25, 1990; Washington, D.C.
**Alfred L. Jacobson,** '27; June 21, 1990; Malden, Mass.
**Percy A. Lovett,** '27; August 10, 1988; Halifax, Nova Scotia, Canada.
**Walter E. Norton,** '28; September 23, 1989; Philadelphia, Pa.
**Samuel R. Weibel,** '28; June 20, 1990; Cincinnati, Ohio.
**Leon P. Brezinski,** '29; May 23, 1990; Brownsburg, Ind.
**Charles M. Broderick,** '29; July 9, 1989; Jamaica Plain, Mass.
**C. Gordon Clark,** '29; April 12, 1987; St. John, New Brunswick, Canada.
**John Q. Cope,** '29; June 4, 1990; Gunnison, Colo.
**Chester A. Ewing,** '29; July 6, 1990; Gardner, Mass.
**Charles J. Miers,** '29; June 29, 1990; Windham, N.H.
**Ralph L. Appleton,** '30; June 17, 1990; Columbus, Ohio.
**Oliver G. Green,** '30; April 27, 1990; Richmond, Va.
**Rose S. Marx,** '30; 1989; New York, N.Y.
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**Kenneth J. Germeshausen,** '31; August 17, 1990; Weston, Mass.
**William D. Harrison,** '31; March 6, 1989; Schenectady, N.Y.
**Aristide P. Micco,** '31; January 10, 1990; Turin, Italy.
**Albert Nagel, Jr.,** '31; July 14, 1990; Hanover, Mass.
**John T. Calvert,** '32; December 4, 1987; London, England.
**Robert G. Cunningham,** '32; 1987; East Weymouth, Mass.
**Harold G. Mangelsdorf,** '32; August 8, 1990; Short Hills, N.J.
**Samuel G. Nordlinger,** '32; June 19, 1990; Fort Lauderdale, Fla.
**Clarence W. Stacey,** '32; September 12, 1988; Venice, Fla.
**Edwin R. Wilkinson,** '32; May 13, 1988; Kissimmee, Fla.
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**Guido M. Garbarino,** '33; June 27, 1990; Bronx, N.Y.
**Joseph C. Gray,** '33; July 27, 1990; Amesbury, Mass.
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**Calvin L.K. Ching,** '52, May 19, 1990; Lihue, Hawaii.
**Orin C. Hansen,** '52; June 28, 1990; Bangor, Maine.
**Edwin F. Tarbox,** '52; July 8, 1990.
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**Janet A. Dwyer,** '55; October 11, 1989; Framingham, Mass.
**Phillip Issenberg,** '57; July 9, 1990; Omaha, Nebr.
**Edward M. Sevadjian,** '60; March 24, 1990.
**Harold E. Benzinger, Jr.,** '62; June 25, 1990; Champaign, Ill.
**Vern V. Berry,** '64; July 20, 1990.
**Paul E. Holland,** '64; July 25, 1990; Renton, Wash.
**David T. Richards,** '71; August 3, 1983.
**John E. Doyle,** '73; June 24, 1990; Burnsville, Minn.
**James E. Kraft,** '77; June 19, 1990; Scarborough, Maine.
**R. Scott MacFarlan,** '79; June 3, 1990; Charlotte, N.C.
**Gerard L. Kaplan,** '81; May 23, 1985; Bellmore, N.Y.
**Mark E. Schaefer,** '83; June 8, 1990; Somerville, Mass.
**Ronald L. Stump,** '85; May 13, 1990; Kettering, Ohio.
**David S. Gill,** '87; June 30, 1990; Santa Ana, Calif.
**David M. Venezia,** '89; July 1, 1989; North Quincy, Mass.
**David G. Moore,** '91; July 4, 1990; Blacksburg, Va.

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## KENNETH S. BROCK

HOME: North Truro, Massachusetts

CAREER: Mr. Brock, MG '48, a native of Woburn, Massachusetts, entered MIT as a student in the Navy's V-12 program, which was established during World War II to give prospective Navy officers a college education. After two years the Navy transferred him and many of his classmates out of MIT, but after his discharge from the Navy at the end of the war, he came back and completed his MIT degree. He then went on to become a marketing executive in the electronics industry. In 1963, he returned again to MIT becoming the second director of the Alumni Fund, and during the next fourteen years, while holding senior development positions at the Institute, had the pleasure of knowing hundreds of MIT alumni. In 1977, Mr. Brock decided to try his hand in the Big Apple. There, he led fundraising programs for the Institute of International Education, the New York Hospital-Cornell Medical Center, and, finally, Polytechnic University. He retired to Truro in 1987 and is now chairman of the town planning board and member of the Cape Cod Commission. He is a recipient of the Bronze Beaver award and a director of the MIT Club of Cape Cod.

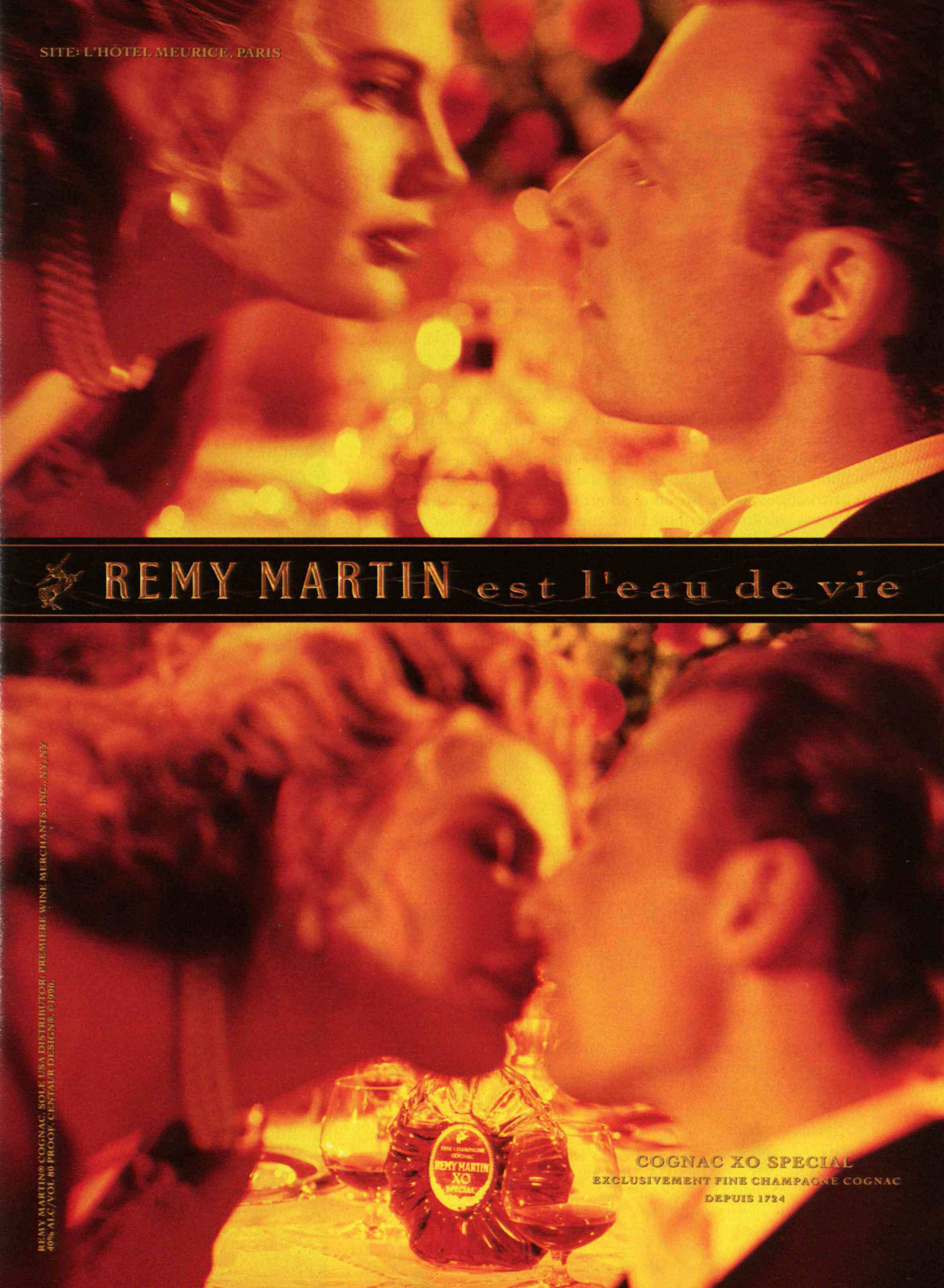
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*Emerging methods for finding, exchanging, and filtering information promise a new era in computer use.*

# Hype

## The Smart Tool for Information Overload

By Robert Haavind

A fire rages on the outskirts of an industrial city. The dispatcher urgently plunks keys as he brings up on his computer screen a city map and finds the warehouse where the caller has reported billowing smoke. The computer reveals that the building contains chemicals that could give off toxic fumes.

After the dispatcher types in the local wind data, the computer reports that a five-block area needs to be evacuated immediately. The stored map shows a fire hydrant located just upwind and west of the site, and the dispatcher flashes detailed plans of the burning building onto the screen so he can call out instructions to the fire chief about where to find the gas and electric cutoffs. One of the buildings downwind is color-coded to indicate that physically handicapped people live there, so the dispatcher knows some wheelchairs will be needed. Less than a minute after the call came in, information is flowing to those who need it and emergency response is in full swing.

The key technology that makes this response possible is hypertext, a method of organizing and interlinking computer information. Once restricted to mainframe computers costing hundreds of thousands of dollars, hypertext has now entered the far less expensive domain of desktop computers. Since 1987, for example, Apple Computer has included HyperCard software—a programming tool suitable for crafting hypertext systems—on all its computers with a megabyte or more of memory.

A fire department can now set up computer-based disaster planning and response using a Macintosh computer and software that together cost less than $10,000. At thousands of fire stations and emergency centers around the United States, Macs can tap into a hypertext database called Cameo II (for computer-aided management of emergency operations). The database spells out the dangers of more than 2,600 chemicals. Thus, if a tank car or truck tips over, emergency personnel can quickly find the information they need. A fire department can also link this database to files listing chemicals stored in its own area.

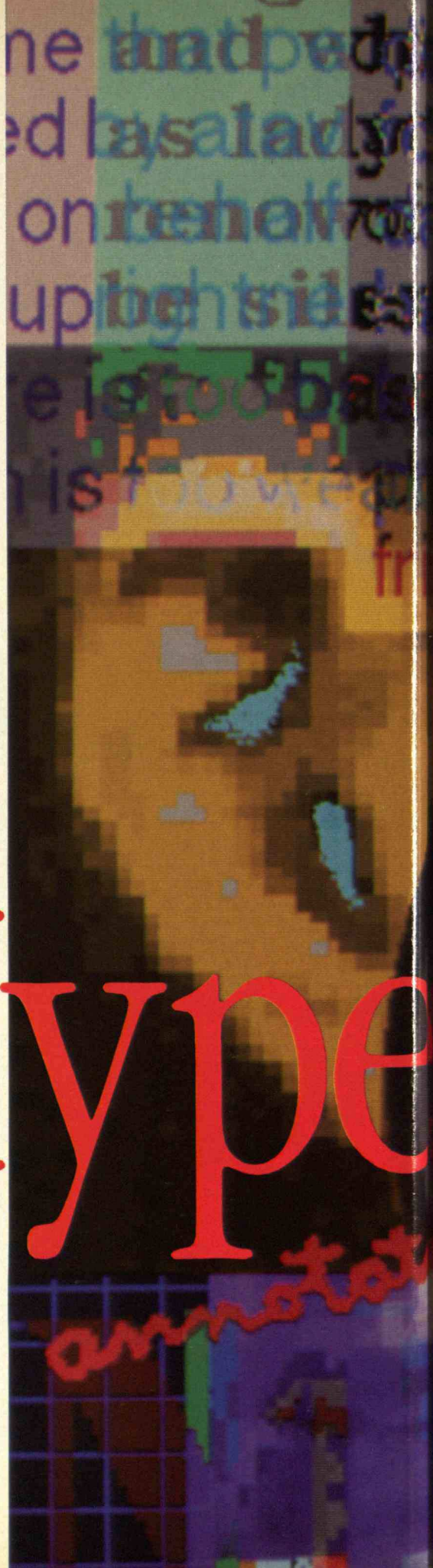


ILLUSTRATION: STEPHEN ELSTON


hypertext
secret he uncovered.
rtext

Olivier's *Hamlet*

*Laurence Olivier and the Art of Filmmaking*, Dale Silviva, Farleigh Dickenson University Press, 1985



Scholars of Hamlet's theatre. Precisely at this moment the soliloquy begins: "To be." For a second we seem to pass through the skull, Hamlet's forehead and closed eyes flash before us. Then the dark waters again shut "or not to be, that is the question:"

The voice-over [illegible] sound with Olivier's gift for epochal resonance. We hear not simply the opening words of the character's meditation. We hear the most celebrated words in all the history of drama. Indeed since Hamlet's image is not even on the screen when Olivier recites the words, their larger frame carries heroic force.

*Forwards & Backwards: A Technical Manual for Reading Plays*, David Ball, Southern Illinois University Press, 1983

AS YOU BEGIN to perceive of Hamlet as driven by irresistible forces, you may be surprised that in the middle of act 3 he seems depressed again and talks of killing himself. You may be too surprised to believe that "To be or not to be" is a soliloquy about suicide. You may even realize it's no soliloquy about suicide. You may even realize it's no soliloquy about suicide. You listeners. Polonius and the K

By act 3, scene 1, Hamlet knows killing himself, and we know But Claudius and Polonius d knows they don't. Hamlet k convinced he has gone over the edge.

Why would Hamlet contemplate suicide? First, ask yourself what event causes Hamlet to come to this particular place at this particular time? If Hamlet knows he has been sent for, and if he knows Polonius is a master spy, then indeed this most famous of soliloquys is no soliloquy. It is a maneuver by Hamlet, who knows he is being overheard by the folks who have sent for him, a maneuver aimed at Claudius to help Hamlet regain stasis in a world that went topsy-turvy in act 1, scene

ACT III/SCENE 1, LINE 29:
Claudius says, "We have closely sent for Hamlet hither."

THE GLOBE THEATRE

The Globe Theatre as we know it was constructed in 1599 but it actually existed as a theatre at a different location prior to that date.

When the lease on the theatre expired at the first location, Giles Allen, the owner of the land, threatened to pull it down because of 'the greate and greevous abuses that grewe by the theater', but his move was anticipated by the Burbages, the owners of the building. In December 1598 or January 1599, they and Peter Street 'and divers other persons, to the number twelve...armed themselves...and throwing down sayd Theater in verye outrageous, violent and riotous sort...did then alsoe in most forcible and ryotous manner take and carrye awaye from thence all the wood and timber thereof onto the Banckside in the parish of St. Maryes Overyes, and there erected a newe playhouse with the sayd timber and wood.'




The site of the new Globe theatre has been disputed, but it now seems clear that it was just south of Maid Lane and south-east of the Rose (see map), so becoming the most easterly of the Bankside theatres.

The land's lease on the new theatre was conveyed in two halves; Shakespeare was just one of nine people owning a stake in the building.

Since the Globe burned to the ground in 1613 (during a performance of Henry IV), what we know of the theater's design been gleaned from other theaters known to have used the Globe's features as a model. It has been said that the Globe was probably round and engravings done of London after the 1620s show the Globe as a cylindrical building. But contracts between the owner and builder of the Fortune Theatre, which was built in

Background

Video

Shakespeare

Hamlet

SHAKESPEARE

*Shakespeare's Progress*, Frank O'Connor, The World Publishing Co., 1968

It is not the ghost-ridden Hamlet who speaks of 'the undiscovered country from whose bourne no traveler returns' or the heir of the throne who has felt 'the insolence of office and the spurns that patient merit of the unworthy takes'; in fact they have been gummed by a glaring non sequitur to the end of the speech on irresolution by a Shakespeare that has become so obsessed by suicide that, although Ophelia's death is a mere suicide, she is buried as though she had been a suicide.

It is futile to speculate on the precise occasion of Shakespeare's [illegible] ous illness. play in 160 Spurgeon h

**Hamlet's Antic Disposition**

*The Elizabethan Hamlet*, Arthur McGee, Yale University Press, 1987

In the literature of the first twenty years of the seventeenth century, Paul S. Conklin said of Hamlet:

His madness was a phenomenon of special interest, in fact, the malcontent was supposed to be suffering from a malady which hovered between melancholy and downright insanity.

In our own time, with the advances in psychiatry, diagnosis has been more specific; in 1962, for example, W.D.

ACT III/SCENE I

*Enter* HAMLET

**Ham.** To be, or not to be, that is the question:
Whether 'tis nobler in the mind to suffer
The slings and arrows of outrageous Fortune,
Or to take arms against a sea of troubles
And by opposing end them. To die—to sleep,
No more; and by a sleep to say we end
The heart-ache and the thousand natural shocks
That flesh is heir to: 'tis consummation
Devoutly to be wished. To die, to sleep;
To sleep, perchance to dream—ay, there's the rub:
For in that sleep of death what dreams may come,
When we have shuffled off this mortal coil,
Must give us pause. There's the respect
That makes calamity of so long life.
For who would bear the whips and scor
The oppressor's wrong, the proud man's contumely,
The pangs of disprised love, the law's delay,
The insolence

**shuffled off this mortal coil:** this can mean either "cast off the yoke of human trouble," or "removed the incumbrance of the flesh."

'Hamlet'

WRITTEN: 1600-1

PUBLISHED: 1603, Q1. 'The Tragicall Historie of Hamlet Prince of Denmarke. By William Shakespeare.'

SOURCES: Belleforest's French version in his *Histories Tragiques* (1576), of the *Historia Danica* of Saxo Grammaticus. There was an old play of Hamlet (the *Ur-Hamlet*), now lost, dated 1589, which may have been written by Ky

Prince Hamlet is the son Denmark, who has recen who, soon after her husb brother Claudius, the ne Hamlet's father appears murdered him after seduc him to avenge his uncle. Hamlet pretends to be m whom he loves. He arran crimes of his uncle, who

HAMLET & KING JAMES VI

*The Renaissance Hamlet: Issues and Responses*, Roland Mushat Frye, Princeton University Press, 1984

SOME THIRTY YEARS before Shakespeare dramatized the responsibility laid upon Prince Hamlet to avenge his father's murder, a similar responsibility was laid upon an actual prince who was told in effect that he was born to set it right. That prince was James VI of Scotland, destined within some three years after the appearance of Shakespeare's *Hamlet* to succeed Elizabeth on the English throne. The historical events in Scotland, involved James' mother, Mary Queen of Scots, and the assassination in 1567 of his father, Lord Henry Darnley, who after his marriage to Queen Mary was known as King Henry. The assassin was certainly the Earl of Bothwell, who shortly after committing the crime of regicide married the widowed queen and moved toward the crown.

James's paternal grandparents the Earl and Countess [illegible] age of revenge squarely upon their [illegible] nes, and did so in one of the most [illegible] to come down to us

HAMLET'S MOTIVATION

*The Intepretation of Dreams*, Sigmund Freud, Translated by A.A. Brill, New York Modern Library, 1950, pg. 310

ACCORDING TO THE still prevailing conception, a conception for which Goethe was responsible, Hamlet represents the type of man whose active energy is paralyzed by excessive intellectual activity. According to another conception, the poet has endeavoured to portray a morbid, irresolute character, on the verge of neurasthenia. The plot of the drama, however, shows us that Hamlet is by no means intended as a character wholly incapable of action. On two separate occasions we see him assert himself: once in a sudden burst of rage, when he st and on the sends the t intended fo him in acc ghost has l offers itself Hamlet is a upon the m has taken h man who s desires of H should hav

The conception that revenge is inadequate unless it exceeds the original wrong has been traced back to Seneca's *Scelera non ulciscris, nisi vincsci* in *Thyestes*.

*Hamlet and the Acting of Revenge*, Peter Mercer, University of Iowa Press, 1987, pg. 201

'To be' seems to have suggested the idea of life as a business of suffering ills, of bearing fortune's outrages. But it is possible to meet such evil with fortitude and contempt rather than with a craven passivity. Thus the phrase 'nobler in the mind' has brought with it an image that sums [illegible] an reason And if 'to nt of 'not rds for 'to

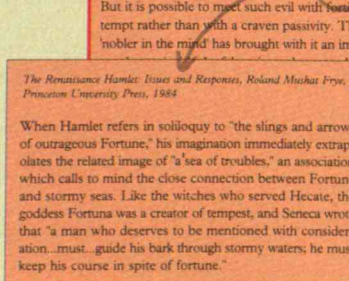
*Freud and Man's Soul*, Bruno Bettelheim, Vintage Books, 1984, pg. 12

"Analysis" implies a taking apart, a scientific examination. English readers of Freud are further thrown off by the fact that in English the accent in "psychoanalysis" is on "analysis," thus emphasizing the part of the word whose connotations are scientific. With the German word *Psychoanalyse*, on the other hand, the accent is on the first syllable—on "psyche," the soul. By coining the term "psychoanalysis" to describe his work, Freud wished to emphasize that by isolating and examing the neglected and hidden aspects of four souls we can acquaint ourselves with those aspects and understand the roles they play in our lives. It was Freud's emphasis on the soul that made his analysis different from all the others. What we think and feel about man's—our own soul—is all-important in Freud's view. Unfortunately, when we now use the term "psyche" in the compound word "psychoanalysis" or in other compound words, such as "psychology," we no longer react to the words with the feelings Freud intended to evoke. This was not true for his contemporaries in Vienna, for them, "psyche" used in any combination never lost its real meaning.

The story of Psyche may have been in particularly attractive to Freud because she had to enter the underworld and retrieve something there before she could attain her apotheosis. Freud, similarly, had to dare to enter the underworld— in this case, the underworld of the soul—to gain his illumination. He alluded to the story of Amor (or Eros) and Psyche in his essay "The Theme of the Three Caskets" (1913, in which he analyzed the unconscious motives that may explain the frequently evoked image of the always fateful choice among three: three caskets in the *Merchant of Venice*, the three

*The Renaissance Hamlet: Issues and Responses*, Roland Mushat Frye, Princeton University Press, 1984

When Hamlet refers in soliloquy to "the slings and arrows of outrageous Fortune," his imagination immediately extrapolates the related image of "a sea of troubles," an association which calls to mind the close connection between Fortune and stormy seas. Like the witches who served Hecate, the goddess Fortuna was a creator of tempest, and Seneca wrote that "a man who deserves to be mentioned with consideration...must...guide his bark through stormy waters; he must keep his course in spite of fortune."




Emblem from 1593 by Theodor de Bry declares "Eupatris est Sapientia" (Wisdom is free from Fortune). In the engr Sapientia is seated at an altar-like desk, with an owl symb wisdom and surrounded by the attributes of learning, ignoring the enticements of a city in the background and in the middle distance a nude Fortuna sailing with her meretricious gifts on display.

**meretricious** adj. [L *meretricius*, fr *meretric-*, *meretrix* prostitute, fr *mereri* to earn—more at MERIT] (1626) 1: of or relating to a prostitute: having the nature of prostitution 2 a: tawdrily and falsely attractive b: superficially significant syn see GAUDY

THYESTES

PELOPS, *the son of Tantalus, had banished his sons for the murder of their half-brother, Chrysippus, with a curse upon them, that they and their posterity might perish by each other's hands. Upon the death of Pelops, Altreus returned and took possession of his father's throne, and sought to gain it by the foulest of means, for he seduced his brother's wife, Acrope, and stole by her assistance the magical gold-fleeced ram from Altreus' flocks, upon the possession of which the right to ru was banished by the k*

*But Atreus has long revenge upon his broth has recalled his brother a place alongside himse have Thyestes entirely*

THYESTES

Quis inferorum sede ab infausta extrahit
avide fugaces ore cpatantem cibos,
quis male decorum tantalo vovas domos
ostendit interum? peius invetum est
siti arente in undis aliquid lapis
gestandus umeris lubricus nostris venit
aut membra celeri differens cursu rot
aut poena Tityi qui specu vasto pate
visceribus atras pascit effossis aves
et nocte reparans quidquid amisit die
plenum recenti pabulum monstro iac
in quod malum transcribor? o quisc
nova supplicia functis durus umbrar
arbiter

BEGINNING LATIN

**Words and phrases**

| | |
|---|---|
| est | is |
| pater | father |
| mater | mother |
| filius | son |
| servus | slave |
| coquus | cook |
| canis | dog |
| in tabilino | in the study |

*The power of hypertext unfolds in this hypothetical treatment of Hamlet. Here the play's script is laced with linkages to information on unfamiliar terms and references as well as background material on Shakespeare and his Globe Theater. An inquiry on the protagonist's state of mind might lead to text by Freud on dreams.*

## Into Another Dimension

Ever since the computer came on the scene, visionaries have realized that it could make possible a giant leap in humankind's intellectual potential: the ability to explore information freely. As far back as 1945, Vannevar Bush, a science adviser to President Truman, postulated a desk-sized unit that would give information workers rapid access to detailed information any time they needed it. Bush predicted that this intelligent storage and retrieval system, which he called a Memex, would be particularly valuable for people who must make quick decisions based on vast amounts of complex data.

The day of the Memex may finally be at hand, thanks to hypertext's new ways of organizing information in a computer. Users of a conventional computer database must define a set of criteria and can then retrieve items that meet these specifications. This is useful for pulling lists of information from a computer, such as all families with two children or more who live in high-rises and have incomes above a certain level. But you have to know what you want before you start; library-style browsing is difficult.

Hypertext presents information in a format that lets the user jump easily from subject to subject, or drill deeper and deeper for more detail on a topic. Screenfuls of computer information are stored as "nodes." The user, by selecting some feature, such as a highlighted word or a labeled button, brings to the screen related information from a linked node. Embedding multiple links into a body of information this way allows the user to move in a number of directions, getting more information where desired or switching to a completely different "hypertrail."

The nodes may blend text with sound, graphics, computer animation, and video. This diversity has led to the term "hypermedia," of which hypertext, strictly speaking, is a subset. Some hypertext systems are preprogrammed to present a variety of options within each node. Other systems allow users to add information and to define new links on their own.

*ROBERT HAAVIND, formerly editor of* High Technology *magazine, is a technology writer and consultant in Boston.*

After following a sinuous track through a maze of information, the user could become "lost in hyperspace." Some systems offer graphical "hypermaps" to help users find their way around a massive pool of interlinked data. As a further navigational aid, every screen may have a button that brings the user back to the beginning of the trail.

Hypertext systems offer familiar icons such as images of drawers in labeled filing cabinets, or simply buttons with arrows or with labels such as HELP or RETURN TO START.

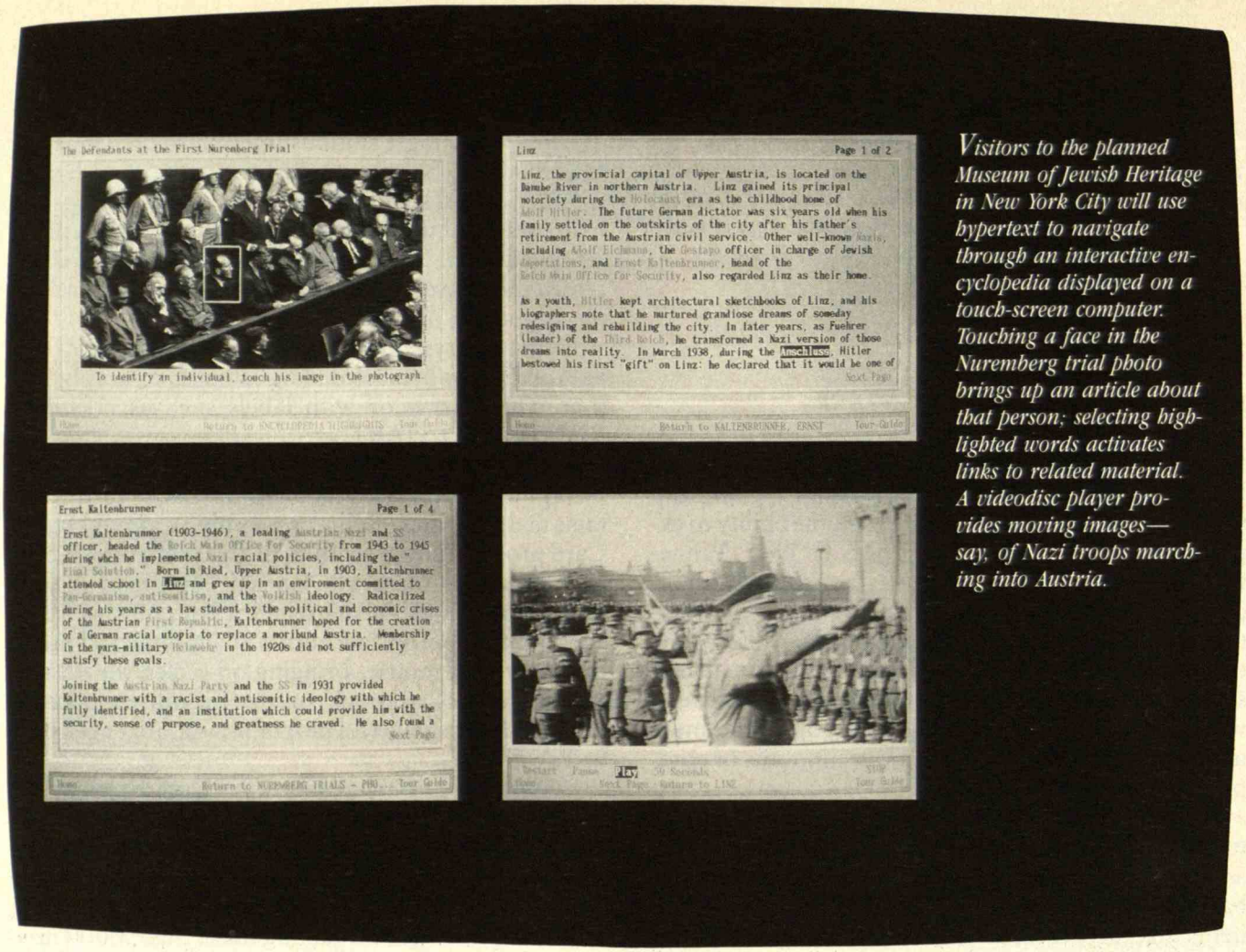
Apple's HyperCard, for example, works on the metaphor of simulated index cards. Each "card" contains text, graphics, audio, or a combination. A HyperCard programmer assembles these cards into "stacks" and interlinks them via labeled "buttons." A user navigates through the material freely by putting a cursor onto the appropriate button at any node and pressing a key on a mouse, bringing on screen the desired card. A HyperCard stack can also include segments of code written in powerful programming languages such as Pascal or C.

With its built-in links among related information, hypertext makes it much easier to get at relevant material buried in vast jungles of data. Visitors to the planned Museum of Jewish Heritage in New York City will use hypertext to sort through the *Interactive Encyclopedia of Jewish Heritage,* containing more than 3,000 articles and 20,000 photos, as well as graphics such as maps and timelines. The encyclopedia also encompasses several hours of full-motion video, including taped interviews with Holocaust survivors. The encyclopedia was developed on an IBM PC using software devised by Cognetics Corp. in Princeton, N.J.

Visitors will be able to home in on information they want and then branch to related material by simply touching a highlighted word or part of a picture. As the visitor navigates through the vast knowledge base, the computer will display text, graphics, audio, and video. Eventually, the hypertext system may also contain a database of 2 million Holocaust victims. A visitor armed with only the last name of a deceased relative will be able to follow "hypertrails" to learn more about the fate of that person, and of others who suffered at the same concentration camp or who came from the same village.

## Hyper History

The term hypertext was coined in the early 1960s by Theodor Holm Nelson, then a Harvard graduate student, to describe his ideas of what he called nonsequential writing. Nelson lamented that computer-stored material lacked multiple connections for finding out




*Visitors to the planned Museum of Jewish Heritage in New York City will use hypertext to navigate through an interactive encyclopedia displayed on a touch-screen computer. Touching a face in the Nuremberg trial photo brings up an article about that person; selecting highlighted words activates links to related material. A videodisc player provides moving images—say, of Nazi troops marching into Austria.*

more about what was on the screen or branching off in new directions. He conceived of hypertext as a method of providing this freedom. Nelson envisioned rapid computer access to any of the world's literature—along with hypertext linkages—from a networked desktop computer.

Working independently of Nelson, a group under Douglas Engelbart at Stanford Research Institute built the first working hypertext system in the late 1960s and the 1970s. Engelbart's Augment system ran on a Digital Equipment mainframe computer and allowed work groups to create and exchange linked information—including graphics integrated with text. Engelbart was studying ways to use computers to enhance (or augment) human intelligence. Out of his work came such seminal developments as the first word-processing program, the mouse, and the blending of text and graphics in the same electronic document. Along the way, he studied fundamental hypertext concepts, exploring ways to embed useful links within the huge bodies of information shared by collaborating groups, such as engineers, designers, and marketers teaming up on a large engineering or software development project.

For decades, hypertext languished in academic irrelevance. Then, in the 1980s, technology began to catch up with theory. Networks began linking personal computers to each other and to larger computers. The cost of information storage plummeted. Huge-capacity, high-speed interactive storage media (such as videodiscs and CD-ROMs) arrived. Combined with fiber optic communications, they made it practical to merge animation, voice, and video with text and still graphics.

## The Capitalist Tool

Hypertext is already serving corporate America. Top management at GTE headquarters in Stamford, Conn., for example, complained about not being able to find needed information in 200-plus-page reports full of charts and graphs. Executives were constantly straining to divine from piles of number-filled reports where trouble might be brewing. Paper reports were hard to index, and because information was scattered, comparisons were hard to make.

The company considered putting financial data and other reports onto a mainframe computer, but found commercial database software prohibitively expensive—from $100,000 to $1 million. Instead, in 1987 the company spent six weeks and less than $14,000 creating a HyperCard system that lets execu-

tives keep up on how the company's many business units are performing.

With hypertext, a GTE executive can pick a figure from a table and with a click get the backup for it. Clicking on monthly sales for a region might bring up a bar chart that breaks them down by product category. Because the system is programmed with a set of figures that represent acceptable business performance, it can flag numbers that deviate.

Hypertext's branching ability provides shortcuts to information. An executive viewing a screenful of data on, say, capital investment in GTE's telephone companies in California can instantly compare these figures with those on the Florida phone operations. With a conventional hierarchical database, by contrast, the user would have to backtrack several steps to a general menu screen and start over. Soon after GTE adopted hypertext, the company's president demanded to get all his reports this way instead of in formal presentations from middle management.

Hypermedia can be just as useful when it blends text with technical diagrams. HyperView Systems of Middletown, R.I., sells a hypertext database that lets users of Macintosh or IBM-compatible PCs explore federal regulations on handling hazardous materials. Clicking on an explanation of how to store drums of a particular chemical, for example, brings up an image in a separate window illustrating the technique. The product also provides links to relevant congressional testimony.

Several companies have turned to hypertext as a training and reference tool for production and maintenance workers. 3M field-service personnel now use hypertext to efficiently find information in a multivolume reference library stored on portable computers. A modem can hook them up to even more current information at headquarters. Procter & Gamble uses hypertext to train production workers and to provide access to operating data on factory machines. NCR's field engineers learn from a hypertext tutorial that starts with simple primers on such basic items as tape drives and disc drives and graphically illustrates tasks like removing a cabinet's back panel, with each screw highlighted by a red label.

### Hypermedia Education

Hypertext has tremendous educational potential. Imagine a hypertext system that starts with a world atlas but then lets the user freely explore related subjects. A curious student might branch from learning about the history of cotton planting in Georgia to the development of the cotton gin, then on to other inventions such as the tractor, the steamboat, and the movie projector, and on to the life of Thomas Edison and his development of the research laboratory. The student might listen to the scratchy sounds of early gramophone records, view snippets of the first motion pictures, and look at copies of the original notes and drawings Edison made of his famous inventions.

Perhaps the best illustration of hypermedia's educational potential is an exploration of Beethoven's Ninth Symphony developed by Robert Winter, a UCLA professor of music history. The Voyager Co. of Santa Monica, Calif., offers Winter's five-part HyperCard program along with a CD-audio recording of the Vienna Philharmonic performing the Ninth Symphony. The progam requires a CD-ROM player attached to a Macintosh Plus or later model.

The five interlinked parts are:

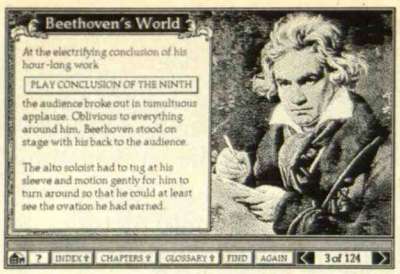
- " Pocket Guide," providing a single-screen overview of the entire symphony, from which the user can choose any major section to listen to.
- "Beethoven's World," which examines the composer's life and times. It includes a discussion of the turbulent events surrounding the debut of the work, and presents excerpts from the "conversation books" the deaf composer used to communicate with those around him.
- "The Art of Listening," which lets one choose segments from the symphony that are then used to explain musical concepts. It also explores the overall architecture of the work, using hyperlinks to relate widely separated passages.
- "A Close Reading," with explanatory text following along in a window next to the score as the symphony plays. A translation of the German in the choral movement appears in a separate window.
- "The Ninth Game," a quiz for one to four players, with difficulty levels ranging from novice to expert.

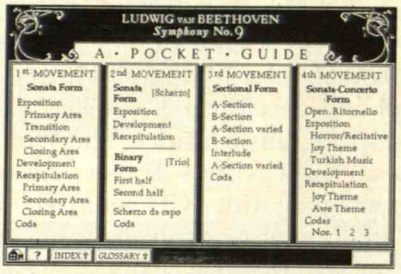
The user can simply listen to the music as the score and Winter's commentary scroll by. Clicking on a button on the screen might interrupt the symphony to go to the scherzo, or perhaps to a copy of Beethoven's handwritten score, which can be listened to note by note by moving the cursor. A musical neophyte might selectively listen to parts featuring particular orchestral instruments while following commentary explaining Beethoven's orchestration.

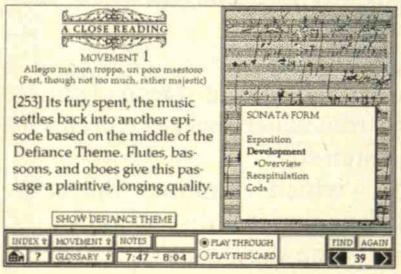
### Groupware

Despite its immense promise for education, hypertext may have its greatest impact in new types of collaborative computer systems called groupware. Under this concept, project teams at scattered sites, or professionals with similar interests, can electronically exchange trails of linked information.

One important new groupware product is Notes, in-







*Using a HyperCard program from Voyager Co., listeners to Beethoven's 9th Symphony can follow hypertext links to learn about the structure of the music and the life of the composer. The screen displays the score while the music plays from a CD.*

troduced last year by Lotus Development Corp. of Cambridge, Mass. Such software, at least so far, doesn't come cheap. Notes has a base price of $62,500 and is geared to organizations that can benefit from connecting hundreds or even thousands of desktop computers into a network. (The base price is for 200 machines, with a $295 license fee for each additional computer.) Notes requires an IBM PC or compatible with OS/2 and Presentation Manager as a central data repository, or server, at each location. Price Waterhouse, an early proponent, plans to buy some 10,000 copies of the program.

Notes users can tap into the Reuters wire service and to Dow Jones for business and financial data, and into other public databases for congressional, financial, international, and other types of current and archival material. To cope with this information gusher (Reuters alone transmits some 15,000 news stories a week, requiring 15 megabytes of storage), Notes includes ways to help users take advantage of this resource without overloading their computers. A FIND command pulls out headlines of only those stories that contain a specified key word. The system can apply a certain amount of intelligence— say, automatically including any item about Exxon in a file folder for "oil industry."

A user can forge a hypertext "hot link" to connect related stories, or to hook headlines from particular stories to memos sent within the organization. That way, the local computer need store only the headline while the full text remains on a larger "server" computer in the network. A note to others on the network may suggest they look at the story associated with the headline. Then any user, by selecting that headline, can bring the full story from the server into his or her own desktop computer. After reading an item, the user can store it along with any desired hypertext links to other material.

The growing use of groupware systems is raising concern about compatibility. Incompatible electronic mail systems already impede the interchange of messages, and in the future similar problems may arise for large hypertext information pools. For groupware to have its greatest value, people using different software at different organizations must be able to exchange hypertext information. A proliferation of proprietary architectures and software may make such interchanges difficult.

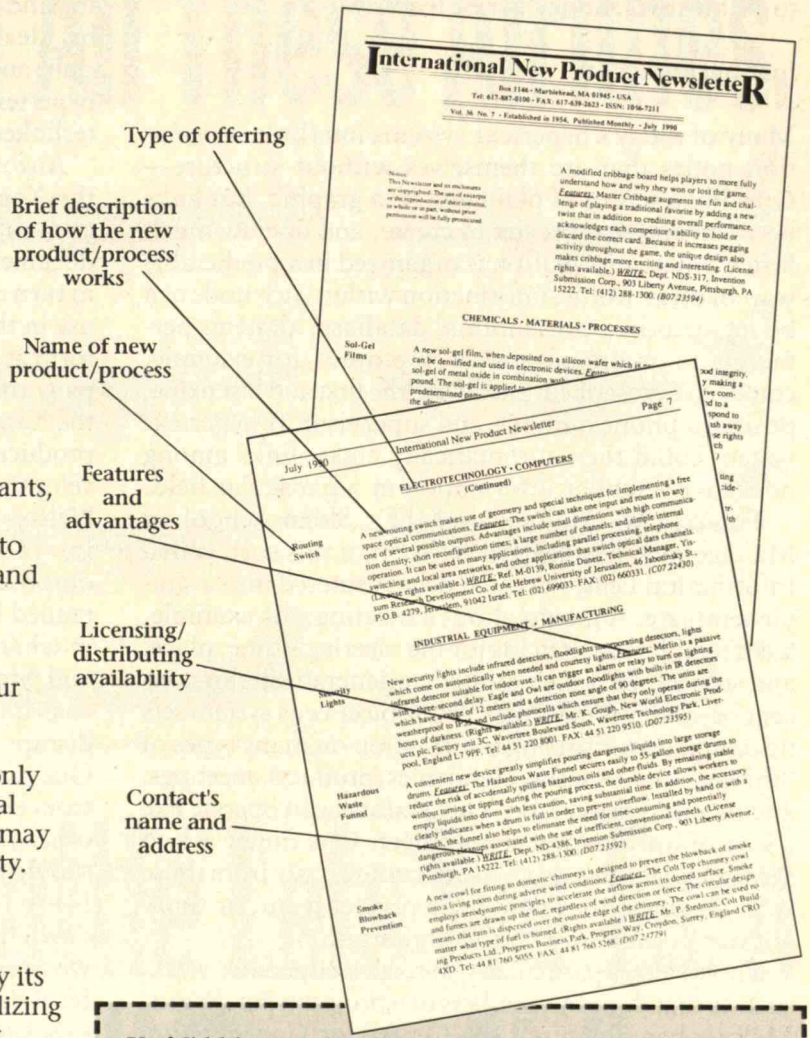
This is already becoming a problem throughout industry as companies begin to work cooperatively. Aerospace companies commonly collaborate on large projects, for example, and automobile assemblers sometimes work with each other and with suppliers on designs and in coordinating design with manufacturing. Even in the comparatively low-tech world of textiles, fabric mills can now gear their production to actual retail sales, thanks to up-to-date information generated by laser bar-code scanners.

The exchange of hypertext-linked files does not require strict compatibility, in the sense of software that recognizes the same codes. Electronic "bridges" can link systems that lack compatible software or hardware. But hypertext does demand "interoperability"—a capacity for differing systems to perform the same functions, even if in proprietary ways. The desktop computing world offers an analogy. IBM PCs and Apple Macintoshes are not compatible, but they are interoperable: virtually all functions done on one type of computer can be done on the other.

Hypertext interoperability would require, among other things, that all systems be able to exchange multiple computer files with embedded links. Hypertext pioneer Douglas Engelbart, now at Stanford University, is spearheading an organization called the Bootstrap Community to promote such interchangeability among hypertext, hypermedia, and groupware documents. The Bootstrap Community includes represen-

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tatives from aerospace companies such as Lockheed, manufacturing companies such as GM, and computer companies such as IBM, DEC, and Apple. The group will work with standards-making organizations to determine what kind of hypertext functions collaborative projects require. To be considered interoperable, an electronic mail or groupware program would have to fulfill this laundry list of features.

### Intelligent Agents

Many of today's hypertext systems interlink information nodes that are themselves without structure—typically a screen of plain text or a graphic. But links between nodes are easier to create, and operate much faster, when information is organized in a predictable way. In other words, information within each node can be set up as in a conventional database; all items pertaining to an organization's employees, for example, could have prescribed "fields" for the first and last name, position, phone number, and supervisor. A hypertext system could then automatically create links among nodes with similar information in a particular field.

Thomas W. Malone of MIT's Sloan School of Management has devised a system of this sort, called Information Lens, in which data is entered into a simple template. A memo about a meeting, for example, has a template with fields for the meeting's time, place, and subject. Malone's group has generalized this concept beyond just messages. His Object Lens system sets up templates for sorting information on many types of "objects," such as tasks, companies, products, meetings, and people. Object Lens, says Malone, can operate like a sort of information spreadsheet. One might ask to see comments on some hyperdocument only from those who belonged to a particular project team, or those above a certain level in the organization.

The system is particularly suited to cooperative work, such as that done by members of a project team. In fact, Malone has organized the Center for Coordination Science, which is developing ways to fit information technology into collaborative work between organizations.

The structuring in Object Lens makes it possible for intelligent software "agents" to rapidly search through and sort information. A "finding agent" searches for items on the network according to rules each user sets up. A "filtering agent," which resides in the user's local computer, helps organize information and sort it according to priority. The system has enough built-in intelligence to take appropriate actions without detailed instructions; it might, for example, automatically send a meeting notice to all those who are listed to attend. By keeping track of the information pathways an individual chooses, these agents could deduce a user's interests and needs. With that knowledge, Object Lens can begin to act like a human reference librarian, perhaps suggesting databases to search.

### Linking the World's Literature

As corporate applications begin to emerge, hypertext's originator, Ted Nelson, is busy pursuing his dream of a global and universally available hypertext system—a technology that would profoundly expand people's access to the world around them. During years of teaching and myriad offbeat and dramatic presentations of his ideas, Nelson has attracted a cadre of mathematicians and designers who have helped him shape a public hypertext system called Xanadu—an electronically interlinked body of documents, music, and art.

Anyone with a computer could view information in the Xanadu system. What's more, they could incorporate items—ranging from a word or phrase to whole documents—into their own creations, which they could in turn contribute to the system for others to view and use in the same way. Xanadu now exists in prototype form at Autodesk, the Sausalito, Calif., software company that Nelson joined recently. Smaller versions of the Xanadu design, encompassing only the documents produced within a single organization, are under development at the Xanadu Operating Co. in Palo Alto. Nelson says the first public Xanadu stations will open in January 1993. These locally franchised outposts—Silverstands, Nelson calls them—will be tended by "smiling young people in silvery uniforms" in what Nelson describes as a "marriage of Star Trek and McDonald's."

Critics of Xanadu worry that such a system would disrupt the orderly and controlled flow of information. One issue is copyright. If pieces can easily be "snipped" from electronic documents on a network and used in other material, who is the original owner and how should royalties be assigned? To cope with this problem, Nelson would have the system tag all material—even down to the level of a small phrase—to keep track of who originated material so that prorated royalties can be assigned.

Scientific publishing could change dramatically if researchers were able to communicate their findings through a global hypertext system. Researchers could make their papers immediately available to the scientific community, subverting the process of peer review.

But advocates of computer-based literature suggest that other methods of critiquing and appraising new ideas would evolve naturally through a more democratic process. Users would soon learn whose comments and questions were worth considering, and could provide feedback on the value of various commentaries and their originators—a sort of electronic revival of the Roman Forum.

For such a system to flourish, computers must be so easy to use as to be transparent. Hypertext offers a good start in this direction. After all, perusing hypertext information relies mainly on that most basic human act—pointing at what you want. ■

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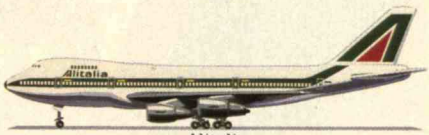


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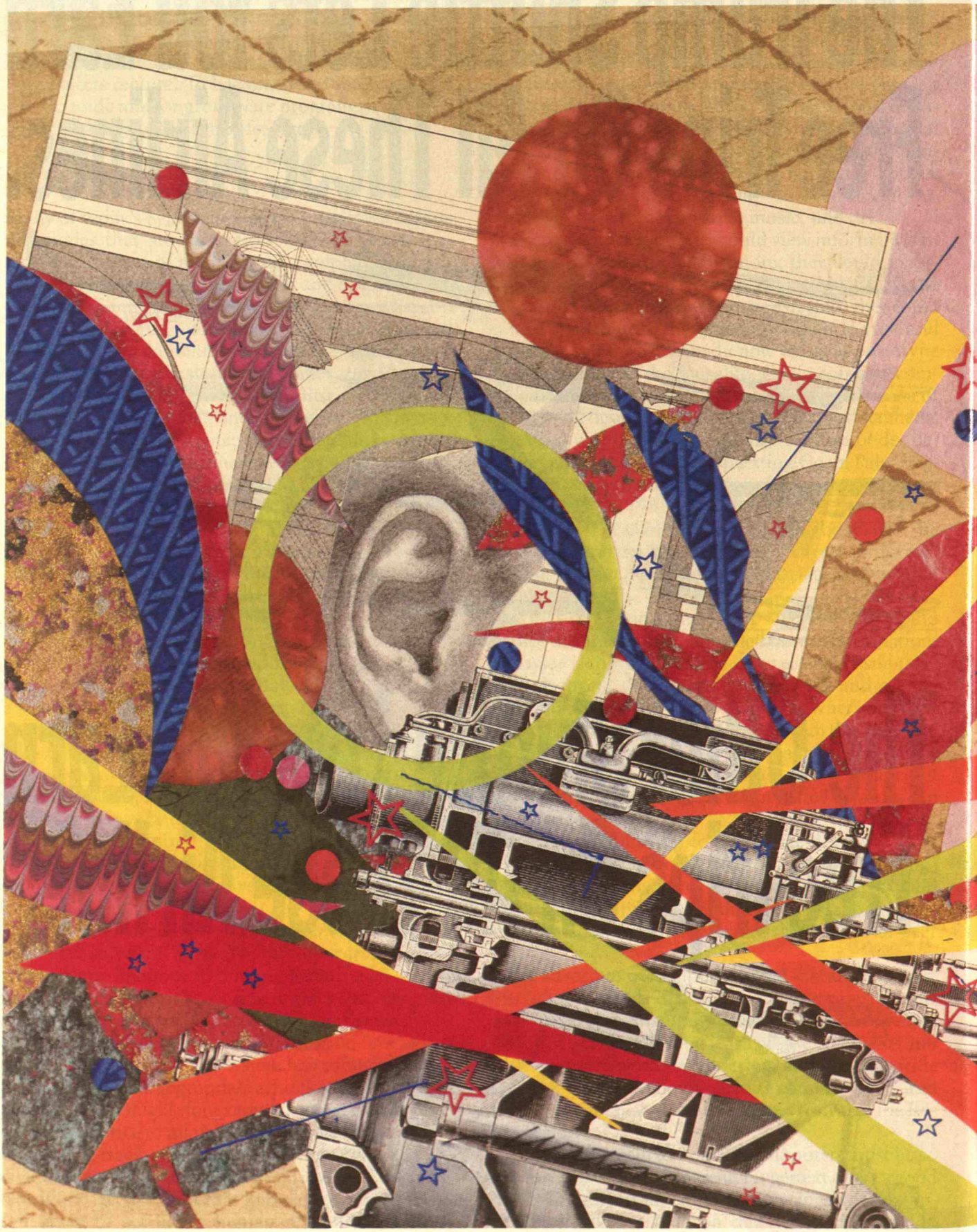
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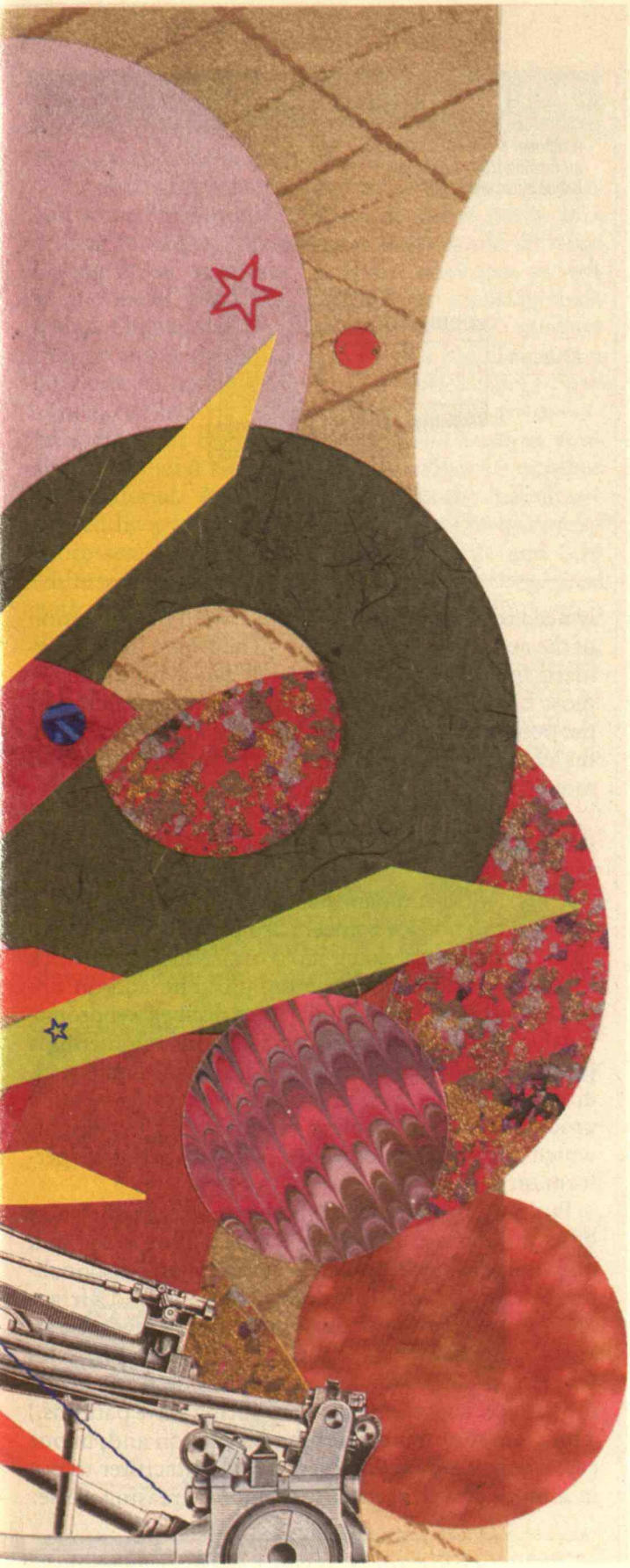


ILLUSTRATION: KAREN WATSON

## Designing Quiet Products

# The Shhh Factor

*As interest rekindles in machines that make less noise, manufacturers must begin to build in "quiet" from the start.*

IN much the way that California drives the other states' air pollution guidelines, Europe is driving the world's manufacturers to consider noise pollution. Attuned to Europeans' vigorous enforcement of noise pollution laws and sensitivity to noise, U.S. companies are starting to develop quieter consumer items—from computers to copiers, dishwashers to lawnmowers. They are interested in making products internationally uniform and in mimicking European designs, which are perceived to have higher quality.

BY RICHARD H. LYON

Spurred by competition from abroad, for example, Harley-Davidson has in the past several years quieted its motorcycles. While that step might seem anathema to macho bikers, Harley figures customers will see this step as part of the company's overall drive for quality.

Until recently, however, U.S. companies tended to pay little regard to the noise sensitivity or intelligence of their customers. Even now product planners put great stock in what seems to be an apocryphal story of a company that made a quiet vacuum cleaner, only to find that customers rejected it because it didn't sound powerful.

But as engineers try to turn down the volume on their products, they need to avoid a trap that too many companies have fallen into: adding sound-attenuating materials after an item has been built. EPA noise regulations imposed in the early 1970s encouraged this practice by failing to give manufacturers enough time to redesign their products. The add-on solution tends to make products more costly, bulkier, heavier, harder to service, and sometimes more difficult and hazardous to use. These drawbacks discourage manufacturers from further attempts to reduce noise. By far the more effective approach is to integrate acoustical requirements into product designs right from the start.

## What's Noisy?

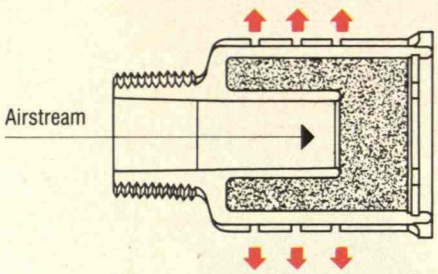
IN developing quiet products, manufacturers cannot ignore the subjective element of sounds. Regulatory agencies set standards on the basis of research on hearing loss, sleep disturbance, and interference with speech. (*See "Noise Wars," TR November/December 1989.*) But the difference between "noisy" and "quiet" also depends on context. The noise from stamping machines that barely meet standards set by the U.S. Office of Safety and Health Administration (OSHA) may not bother their operators because they are concentrating on the machines' tasks. But a person trying to close a business deal over the phone may find the hum of a nearby computer terminal unbearable. And to a suburbanite sitting on a patio, the vroom of a passing motorcycle may be much more disturbing than a neighbor's equally loud lawnmower.

Rattles, random clicks, and nonharmonic tones are especially bothersome. A manufacturer of motors for a shop-type vacuum cleaner once asked me to solve a noise problem—not the roar of the motor but a barely audible rattle produced when the machine was turned off. The producer worried that the motor would sound defective.

Unfortunately, the field of psychoacoustics has virtually ignored perceptions of product sounds. So to figure out what noises disturb people, companies usually need to test goods individually. With the exception of the automotive companies—which have long recognized that buyers associate quiet cars with quality—most firms have resisted taking on this research. But the potential for making the right design choices, and therefore attracting more buyers, is worth the time and money.

**DIFFUSION**

A diffuser's wire mesh spreads air flowing from a pipe and hence cuts noise.




## Integrating Quiet

ONCE a company has decided that a product is too noisy, engineers usually take a Band-Aid approach, doing most of the acoustical work after finishing the design. The add-on approach has generated a "dollars-per-decibel" syndrome, in which designers trade off the benefits of quieting a product with the impact on its price. But designers seldom think that way about other parameters of a product—such as cooling requirements or weight, which they usually consider to be essential to performance.

Building in quiet from the beginning might solve other problems as well. For example, I have found that noisy sewing machines can be made quieter by punching holes in their bottom cover. (When a solid surface vibrates, the air on the outside moves in waves, creating noise. But when a surface studded with holes vibrates, much of the air on the outside flows inside the surface, canceling noise-producing wave patterns.) This change also increases the ventilation and, in one case I consulted on, enabled the manufacturer to put in a more powerful motor without increasing noise.

*RICHARD H. LYON directs the Industrial Program for Structural Acoustics at MIT, where he is a professor of mechanical engineering.*

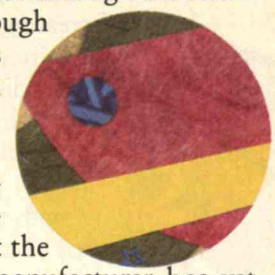
In general, noise-causing vibrations can be stopped at three places in a product: at the source, along the line of transmission, and at the boundary between a product and the surrounding air.

To deal with noise in the first category, engineers can sometimes modify the source of the noise. In a sewing machine, for example, gears made of long-lasting nylon or another polymer work just as well as the metal gears that produce the clackety-clack sound. Similarly, the shaft of the chain drive's sprocket that produces the grinding noise in a bicycle when a gear doesn't go into place or in an office copier drive system can be fitted with a resilient bushing that isolates the shaft from the frame. Such a bushing consists of a metal sleeve encased in rubber or another soft material. And to reduce the noisy turbulence caused by a jet of air (a problem in some industrial processes, such as stamping), designers can add "diffusers" to the air outlet. A diffuser—a tube fitted with metal meshing—slows down the air by forcing it through the screening.

A wonderful example of reducing the source of noise is a Dutch nail-making machine that rolls rather than hammers out the head of a nail from the metal shaft. Not only is the process quieter, but it doesn't require oiling and then degreasing the metal.

Although acoustical engineers can often come up with innovative solutions like this, sometimes the source of noise is intimately related to the basic machine process. For example, a diesel engine rattles because of the rapid pressure change each time combustion starts inside its cylinders. Injecting fuel more slowly makes combustion more gradual, and thereby diminishes the noise. But the fuel then burns at a lower temperature, reducing power and adding to noxious emissions.

In such a case, acoustical engineers next consider reducing the vibrations transmitted through the structure. Noise typically travels through shafts, bearings, and the linkages between them. Engineers can deal with this problem in a variety of ways. For example, I have found that resilient bushings around the crankshaft bearings of a diesel engine can quiet the machine—a solution that no manufacturer has yet adopted.



One way acoustical engineers cut noise transmission is by reflecting the energy back to the source. The resilient rubber feet at the base of a typewriter—called isolators—do just that. So do "inertia blocks"—reinforced concrete slabs that support heavy air-conditioning systems in large buildings. Resting on springs, the blocks prevent the floor from shaking and creating noise (and sometimes structural damage) throughout a building.

Most often, engineers cut transmitted noise through another technique, damping. In this case pliable materials or liquids dissipate energy by deforming. For instance, shock absorbers attached to the suspension of a car reduce vibrations by forcing oil through small passages. But damping has many limitations. When a panel of a machinery housing is corrugated, as a printer cover may be, or otherwise stiffened structurally, it becomes more expensive and difficult to damp. In part, more surface area means that more damping is needed. Also, the damping material has to be stiff enough to share in the storage of the potential energy of the vibrations, yet pliant enough to dissipate it gradually. The solution is costly laminates.

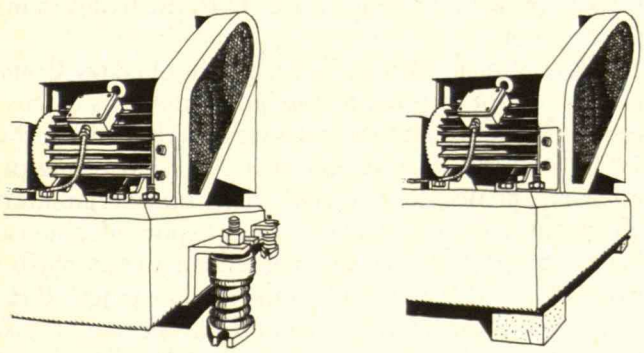
Acoustical engineers have one more trick in their bag if they cannot modify vibrations at their source or halt them along the transmission path. They can reduce radiated sound. A product's flat surfaces generally act like a diaphragm, transferring structural vibrations to the surrounding air.

To reduce the noise coming from these surfaces, engineers can sometimes use damping mechanisms as they do earlier along the noise path. In an automobile, for example, the tarlike rust preventative that is sprayed on the car body provides some damping.

A more effective way to lower sound radiation is to reduce "coupling"—the extent to which surrounding air moves as a surface vibrates. If for some reason one wanted to make a loudspeaker quieter, one could punch holes in the cone. The vibrating air next to the

## ISOLATION

A concrete foundation with steel springs or synthetic rubber supports halts transmitted vibrations and therefore noise.



DIAGRAMS: TOM BRIGGS DESIGN

cone would then flow quietly through the holes to the inside rather than exerting pressure outside the speaker and creating noise.



Engineers can also diminish coupling by replacing solid plates with frames, perforated plates, or grillwork known as "expanded metal," in which a sheet of metal cut with numerous parallel slits has been stretched so that the slits widen. Expanded metal is particularly suitable for supporting subassemblies that carry motors and drive elements in computer printers and paper-handling machines. These machines are not very heavy and so can rest safely on open structures.

### Who Will Pitch In?

DESPITE the many techniques available cutting noise, most U.S. companies are ill-equipped to design quiet products. Most design engineers have not had courses in acoustics. At MIT, for instance, acoustical design is not part of the main mechanical engineering design courses. And even those people around the country who do study acoustics usually end up in classes that teach the Band-Aid approach to reducing noise.

A few companies—including General Motors, Xerox, General Electric, and FMC Corp., which makes food-processing machinery—have started sending engineers to acoustical design courses. Many more need to.

For their part, universities have to introduce the concept of quiet product design into the engineering curriculum. Since instructors familar with this approach are rare, experts may have to be brought in part-time.

Schools will also need more funding for acoustics research. Most of the money for this field has traditionally come from the Navy, but those funds are not likely to increase in the near future. Thus the ball is in industry's court.

The current atmosphere is not like the old days. Companies cannot respond to foreign regulations or customers by running to their lawyers, as they did in the 1970s after new U.S. regulations. And if Washington is smart, and decides to revive federal noise-regulation efforts through incentives like tax or export advantages for quieter products, companies will have every reason in the world to respond with improved products. If industry wants the United States and European markets, its products will have to be quieter. Industry leaders must commit to making "quiet" an essential product feature. ■

## DAMPING

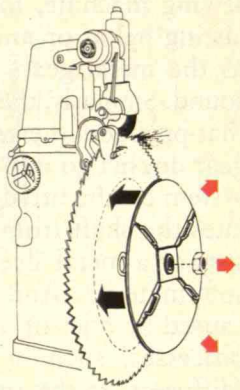
Tapping a resonant object produces vibrations.



Damping limits vibrations.

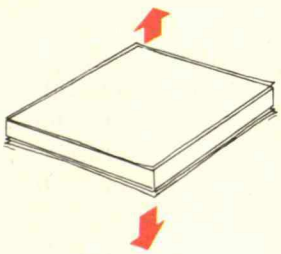


A stiffened disk with rubber on it can be attached to a saw blade to reduce noise.

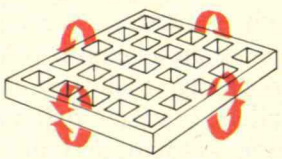


## PERFORMATION

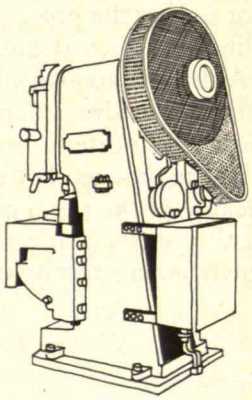
A vibrating panel creates noise.



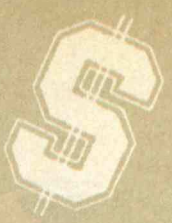
Many openings cut noise.



A perforated cover over a flywheel and drive belt is quieter than a solid one.









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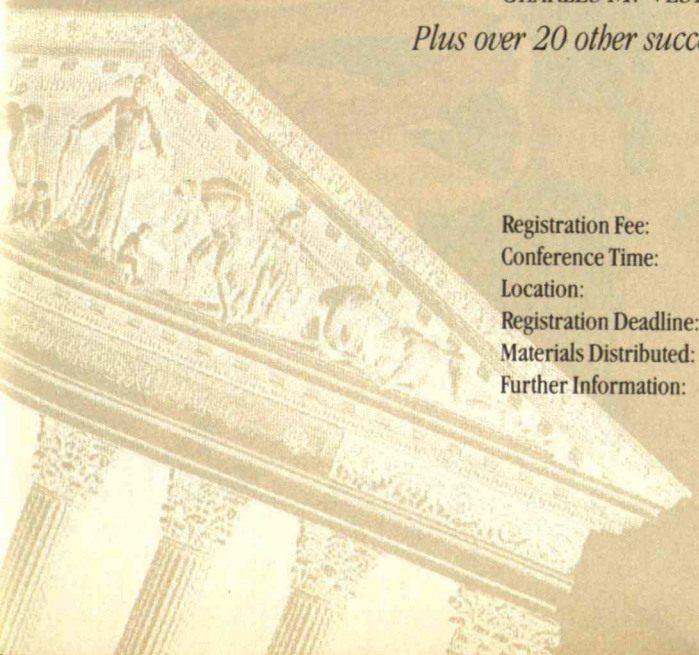
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*PHILLIP A. SHARP—Co-Founder, Biogen, Inc.*
*CHARLES M. VEST—President Elect, MIT*
*Plus over 20 other successful entrepreneurial leaders*



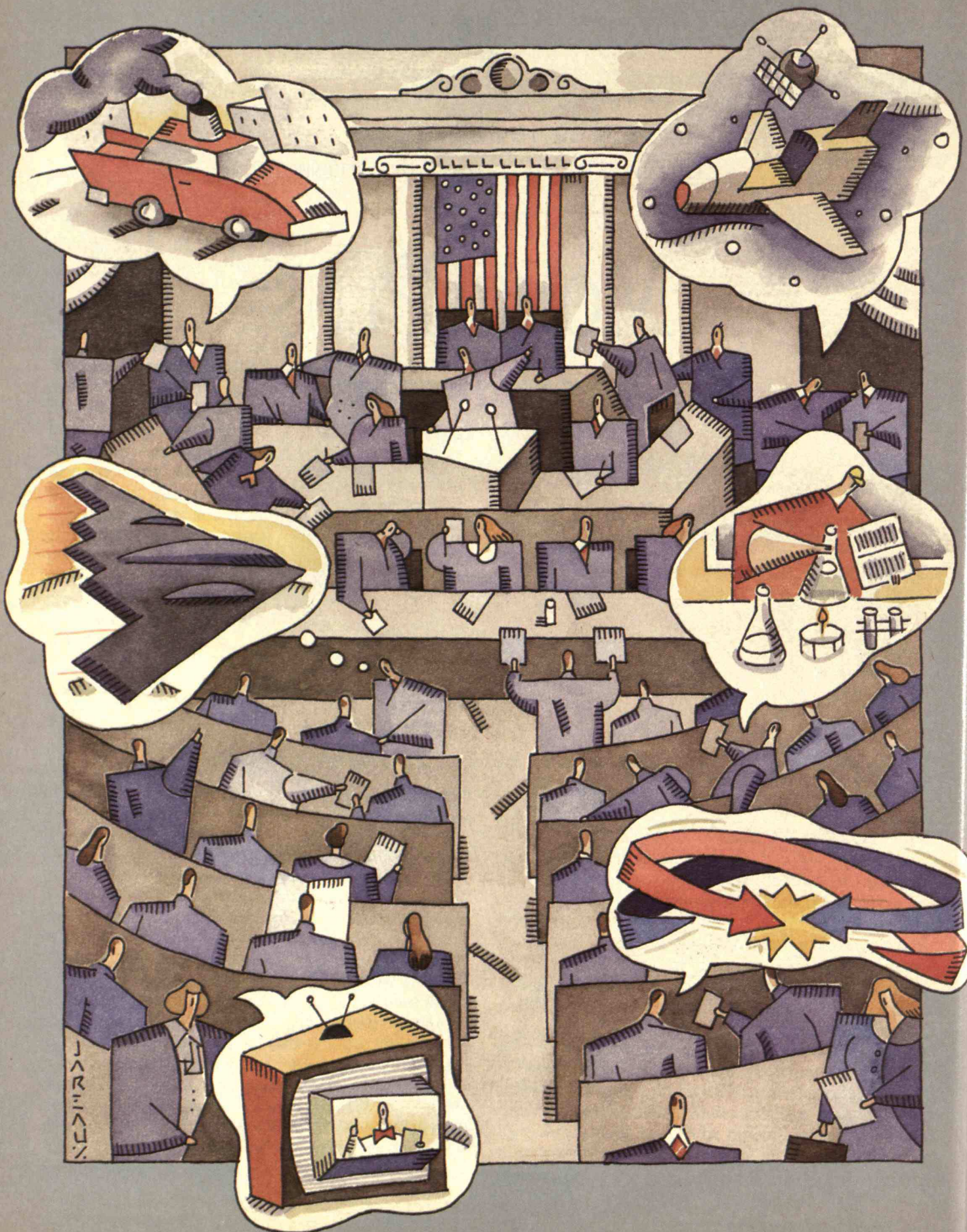








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JARRAU

A SPECIAL REPORT FROM
*TECHNOLOGY REVIEW*

# Science and Technology in the 101st Congress

BY WADE ROUSH

*Congressional say over science and technology is growing along with a rising consensus that the reins of management should accompany the power of the purse.*

WHEN the framers of the Constitution gave Congress the power "to promote the progress of science and useful arts," they couldn't have foreseen the extent to which the legislature would one day preside over technological decisions. Yet the framers' document has adapted more or less resiliently to the demands placed on it by an industrial revolution, two world wars, and four decades of economic expansion and superpower competition.

Today, congressional power to determine the pace and direction of innovation is multifold, and the 101st Congress has worked actively to extend and solidify that legislative role. Whether attempting to enhance the competitiveness of high-tech industries or math and science students, whether spending billions on the Superconducting Super Collider or withholding billions from the stealth bomber, Congress has set the terms of debates that were once the purview of technical experts. This is in part because our 535 senators and representatives are the only ones who can transform words into the law of the land. But another reason is a spreading consensus that the reins of management should come with the power of the purse.

In 1989 and 1990, the House and Senate grappled with questions as diverse as how to clean the air, whether to send people to Mars, and what it's worth to illuminate the nature of matter. Their deliberations confirm that science and technology are as much political enterprises as voyages of discovery and invention, and that the pork barrel, the turf battle, and the search for quick fixes drive the process as strongly as old-fashioned curiosity.

As a result, armies of lobbyists and analysts hang on lawmakers' every word about R&D spending, industrial policy, weapons development, and the space program. "The flick of a wrist in Washington causes people to move across the country," marvels John Pike, director of space policy for the Federation of American Scientists.

The same questions, and the positions of elected officials on them, matter to all of us. In this special report, *Technology Review* analyzes six of the most consequential and rancorous science and technology debates in the 101st Congress. They embody the complex relationship that has evolved between Congress, the scientific and technical communities, and the public. If a roll call has occurred on a crucial bill or amendment, we report the "yeas" and "nays" of each member on page 66. While the tallies obscure the negotiation and other politicking that go into any congressional decision, the chart shows the final position of each representative and senator.

*WADE ROUSH is a free-lance writer and a doctoral student in MIT's Program in Science, Technology, and Society. He prepared this article as an intern at* Technology Review.

ILLUSTRATIONS: ROBIN JAREAUX

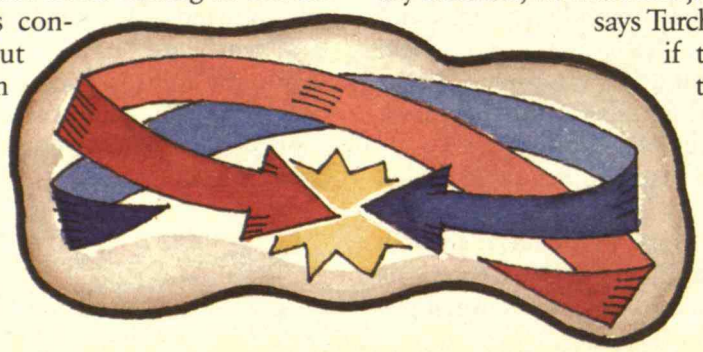
# The Superconducting Super Collider

THE world's most expensive hole in the ground"—that's what critics call the Superconducting Super Collider (SSC), the instrument that could make or break physicists' most basic theories on the nature of matter. While the epithet isn't strictly accurate—the English Channel tunnel and the depression of Boston's Central Artery will both cost more than the Waxahachie, Tex., dig—the SSC will be by far the biggest of big-physics projects to date.

Some 10,000 superconducting magnets in the planned 53-mile, racetrack-shaped tunnel will accelerate subatomic particles to nearly the speed of light and hurl them against one another at an energy of 40 trillion electron volts (TeV), more than 10 times the energy of the most powerful existing accelerator. When completed around the year 2000, the machine seems certain to recapture the U.S. lead in high-energy physics. Physicists promise that a 40 TeV accelerator will let them either uncover holes in the theory of matter or complete the subatomic menagerie by finding elusive particles, such as the top quark and the Higgs boson.

Some members of Congress fear the project is a costly boondoggle that diverts funds and talent from more important efforts, such as high-temperature superconductors and materials science. When Ronald Reagan endorsed the collider in 1987, the Department of Energy estimated the cost at $5.3 billion in inflation-adjusted 1988 dollars. Since then, design changes and revised estimates of labor costs have pushed the price tag to about $8 billion. But like any outsized project, the SSC has a pork barrel to match, and with 2,600 contracts going to companies and universities in 36 states, efforts to curb the rising costs have fallen by the wayside.

For example, in a key compromise muting opponents, the House voted in May to cap federal SSC spending at $5 billion, with Texas adding $1 billion and foreign participants contributing $2.4 billion. But the compromise soon evaporated as the House and Senate appropriations committees both approved President Bush's full $318 million request for the SSC in FY 1991, without any restriction on future costs or requirements for foreign help.



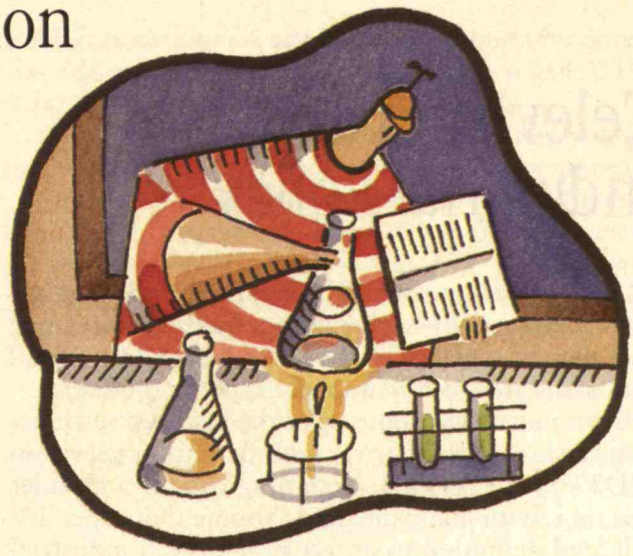
One reason for the SSC's apparent immunity is that it gets funded through the essentially veto-proof appropriation for energy and water development. Known on Capitol Hill as the "all-American bill," this annual measure divvies up construction projects among many congressional districts. More than half the 25 new water projects in the FY 1991 House version would benefit the states and districts of the 57 House Appropriations Committee members. Their counterparts in the Senate stripped out much of that pork and inserted their own, including $150 million for projects in Louisiana, the home of Energy and Water Subcommittee chair J. Bennett Johnston (D-La.). In exchange for constant funding for the super collider, the White House tolerated what it called "excessive and unjustified" spending it hadn't requested.

Several legislators have accused the Energy Department of "lowballing"—submitting unrealistically low estimates—and upping the ante once contracts and the collider were too big to stop. Referring to projects like the SSC and NASA's Hubble Space Telescope and Space Station, Bob Traxler (D-Mich.) told advocates to "come clean" at a recent House Appropriations hearing. "Mega-science projects are intentionally sold to us with a low price tag," he said. "As the project begins to gain momentum, it gains friends within the Congress and outside in industry, and those kind of supporters will be able to roll in the high numbers."

On the other hand, Bill Turchinetz, associate director of MIT's Bates Linear Accelerator, suggests that the apparent lowballing and pork-barreling is "more serendipitous than sinister" in the SSC case. He says that unforeseen design flaws serious enough to cripple the accelerator led to the cost increases, and that contracts are distributed around the country because "the capabilities aren't located all in one place." Nonetheless, "had all that money been spent in Texas, there wouldn't have been as much interest."

What will the billions buy in the end? "If history is any indicator, we won't find just what the theories expect," says Turchinetz. "On the other hand, if there ain't nothing there, that's incredibly important, too." In either case, Congress seems happy to ride the physicists' bountiful bandwagon.

# Science and Math Education



NOT all the talk of pipelines and leaks this year had to do with Alaskan oil spills. The leaky pipeline some lawmakers refer to is the one that transmits scientifically adept young people from grade school to graduate school to careers. A host of measures aimed at bolstering the ranks of scientific and technical professions and recovering the competitiveness of U.S. children in math and science are circulating on Capitol Hill. Some are substantive, others mainly symbolic, but all reflect a sense of high urgency. In a recent achievement test, U.S. high school students ranked ninth in physics among 13 countries, eleventh in chemistry, and last in biology.

President Bush has called for programs to make U.S. students "first in the world" in math and science by the year 2000. But even supporters of the steps Congress is taking toward achieving that ambitious goal say they are half-measures. "It had better be a very, very long 10 years," says Rep. Thomas Sawyer (D-Ohio).

Faced with a predicted shortfall of technical talent, declining math and science test scores, and National Science Foundation (NSF) education programs that shrank significantly during the Reagan years, members of Congress have diagnosed a crisis in how the United States prepares its technically minded youth for a competitive high-tech world. "We cannot take the supply of scientific talent for granted," says Rep. Doug Walgren (D-Pa.). He has sponsored a bill to express the government's commitment to science education by awarding four-year, $5,000-per-year science and engineering scholarships to one young woman and one young man from each congressional district.

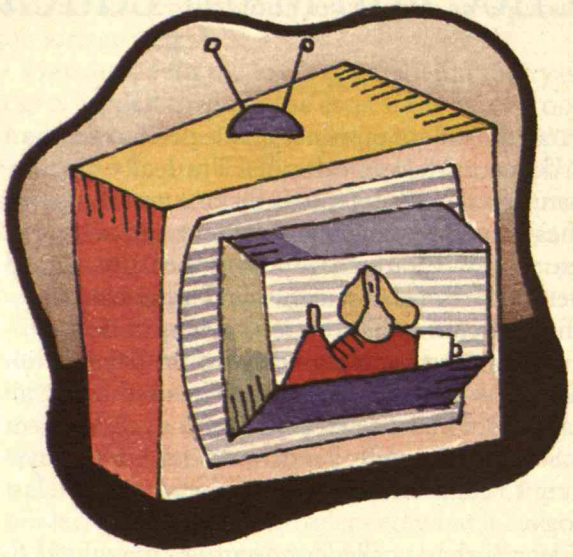
The House approved Walgren's "Congressional Awards for Science and Engineering" a year ago, and they have since become part of a $250 million omnibus education bill passed by the full House July 17. The next day, the Senate Labor and Human Resources Committee approved a bill containing similar provisions but costing only half as much.

Spread among thousands of school districts, even $250 million may not yield substantive gains. Margaret MacVicar, dean of undergraduate education at MIT, worries that the Walgren proposal "isn't going to help new people get in" scientific fields, since the merit scholarships will go to students already versed in science. Still, the prestige of the congressional imprimatur will build a "cadre of winners" who can lead by example, says MacVicar, who was an overseer of NSF's recent reorganization of its science education programs.

Some educators charge that congressional initiatives to improve student test scores will not address the root causes of lagging U.S. competitiveness in technical fields. "I think their solution is the usual simplistic, administrative solution—throw money at it," says New York University emeritus physicist Morris Shamos. Author of the forthcoming *The Myth of Scientific Literacy,* Shamos says, "The suggestion that we have to compete with Japan on the industrial level by making our citizenry more literate in science is simply invalid." Instead, the reason for supporting programs like Walgren's is to give the brightest young people more meaningful incentives to enter the tough discipline of science.

All in all, even critics realize that Congress is working within budget constraints and a crowded calendar to bridge the gap between lofty goals and the reality of a worsening attrition rate among science-oriented youngsters. "Congress has been acting rather well in terms of supporting science and math education" by reversing Reagan-era cuts to NSF's science education programs, admits Shamos. But, he adds, until something can be done to increase the rewards for entering science, "I don't see what progress will be made."

# Television and Industrial Policy



LOOK closely at your TV. That fuzzy, vibrating image, essentially unchanged for half a century, may soon be replaced by signals so detailed you could read standard-sized newspaper type on the screen.

Even more important, over the last two sessions, congressional debates over high-definition television (HDTV) have become a lightning rod for a broader question, with many members hoping that super TV will lend definition to an active high-tech industrial policy for the United States.

In fact, HDTV is a visible rallying point for a host of concerns about U.S. competitiveness in cutting-edge technologies. HDTV promoters believe that without a government-industry partnership to fuel their effort, the nation will lose its leadership in other fields. But developing a home-grown HDTV industry in the face of Japanese and European competition could require a degree of cooperation between government and industry that free-market conservatives strongly resist.

How can a country's technological future ride on a better boob tube? The reason, say its supporters, is that the advanced TVs will gobble up computer memory chips and microprocessors, driving innovation in semiconductors and other information-processing fields. "Computers and communications are converging," says Robert Cohen, a fellow at the Economic Policy Institute in Washington. "To fail to make the jump ahead is going to leave you out of the vast part of what is going to be defined as the electronics industry in the twenty-first century."

If the United States cedes HDTV to Europe and Japan, it risks "missing out on the twenty-first century," says Rep. Don Ritter (R-Pa.). Thus, the members of a House bipartisan "HDTV caucus" want to lend electronics firms more than $1 billion over five years to help them build plants and weather low profits for a decade of development.

Already the United States is as much as 10 years behind in the race to build HDTV, according to the caucus. Japanese firms have been working on HDTV since 1970, and have built several working systems. In 1986 Eureka 95, a coalition of European governments and electronics firms, launched a $100 million effort to develop its own version of HDTV.

Most U.S. electronics firms, represented by the American Electronics Association, assert that U.S. industry will be at a disadvantage as long as it lacks the support of a centralized industrial-policy agency like Eureka or Japan's Ministry of International Trade and Industry. Says House Telecommunications Subcommittee chair Ed Markey (D-Mass.), "The Japanese and Europeans are in the eighth inning of a tightly contested ball game. And America is about to jump in the station wagon and look for the ball park."

Parallel bills passed in the Senate and the House would channel funds to commercialize HDTV and other economically critical technologies through the Advanced Technology Program (ATP). Congress established the ATP in 1988 while reshaping the National Bureau of Standards into the National Institute of Standards and Technology (NIST), a body that could become the main vehicle for improving U.S. competitiveness.

However, the Bush administration has other ideas, putting the ATP at the center of a tug of war over whether the government or the free market should determine which technologies to develop. The administration asserts that the public-policy process is too clumsy and sluggish to pick the right technologies for development. Bush requested only $10 million for the ATP for FY 1991, compared with a House-passed bill authorizing $100 million in FY 1991 and $250 million in 1992. The 327–93 margin of approval indicates a significant rejection of the hands-off White House approach, even among top Republicans like Robert Walker (R-Pa.) and Newt Gingrich (R-Ga.).

The Pentagon has entered this legislative-executive battle in the wake of a Defense Science Board warning that the shrinking U.S. electronics industry threatens the nation's security. Last year, Craig Fields, then-director of the Defense Advanced Research Projects Agency (DARPA), announced that his agency would distribute $30 million to companies to study HDTV, widely considered to be a "dual-use" technology—one with military as well as civilian applications. But apparently that action cost Fields his job in April, to the dismay of congressional technology advocates. For example, Sen. Albert Gore (D-Tenn.) criticized the firing, saying, "Craig Fields made himself unpopular with those at higher levels in the Defense Department and in the administration who . . . don't see the relationship between science and defense, science and technology, and the American industrial base as the foundation for all else."

Since Fields left DARPA, the agency's funding for HDTV has fallen to only a few million dollars. But in July the House Armed Services Committee approved a defense authorization bill that would earmark $322 million more than the administration request for potential dual-use projects within DARPA such as HDTV, x-ray lithography, and computers.

If DARPA can't have a hand in civilian technology, Sen. John Glenn (D-Ohio) wants to create a nonmilitary body that will. His proposed Advanced Civilian Technology Agency (ACTA) within the Commerce Department would supersede the ATP. Glenn thinks NIST, like its predecessor, is good at measuring things but isn't structured to foster high-tech projects the way DARPA does.

With the Gramm-Rudman-Hollings budget ax hanging over Congress, it may be money trouble, rather than the industrial policy debate, that determines whether the HDTV sets in U.S. homes over the next decade are labeled Zenith or Sony. The government-industry collaboration that sent astronauts to the moon in the 1960s isn't forgotten; it has just become a lot more expensive. And as a stimulus for action, Japan's takeover of consumer electronics has been far less sudden and dramatic than *Sputnik*. Congress must decide whether more is at stake in the HDTV race than national pride.

# Amending the Clean Air Act



REWRITING the laws that protect our most basic natural resource has proved to be one of the biggest challenges facing Capitol Hill lawmakers in the 101st Congress. That effort to amend the 1970 Clean Air Act was also, in the estimation of Sen. Robert Dole (R-Kans.), the most important—outside of the regular "housekeeping" issues.

Assembling the 1,300-page bill in a House-Senate conference committee this summer was like building a house of cards. Struggling to enact the first major revisions to clean-air regulations since 1977, lawmakers had to balance home-district economic concerns against powerful environmental sentiment. The result, fears Richard Ayres of the National Clean Air Coalition, is a bill full of "so many delicate compromises" that it risks being "ripped apart" by the competing interests even before reaching President Bush's desk.

Most members of Congress agree that the original Clean Air Act hasn't improved air quality enough. The act ordered the Environmental Protection Agency (EPA) to set standards that would provide "an ample margin of safety to protect the public health" from all toxic air pollutants. In the ensuing 19 years, EPA has identified some 200 such pollutants but has standards for only 7.

EPA proponents have defended its slow action on the grounds that no "safe" level exists for most pollutants; a strict interpetation of the law would have meant allowing no emissions—and shutting down major segments of industry. The solution a more pragmatic Congress has adopted this year would not impose a health standard but rather require firms to use the "maximum achievable" pollution-control technology,

taking cost into account. Thus, companies would be encouraged to adopt clean-coal technology, or power plants could install better pollution-reducing scrubbers. Another key provision would strengthen limits on automobile emissions beginning in 1994, with a second round of even stricter controls in 2003. Congress has also set new timetables for bringing most cities into compliance with smog standards by 2000 (Los Angeles gets until 2010), while controls on coal-burning utility plants could reduce acid rain.

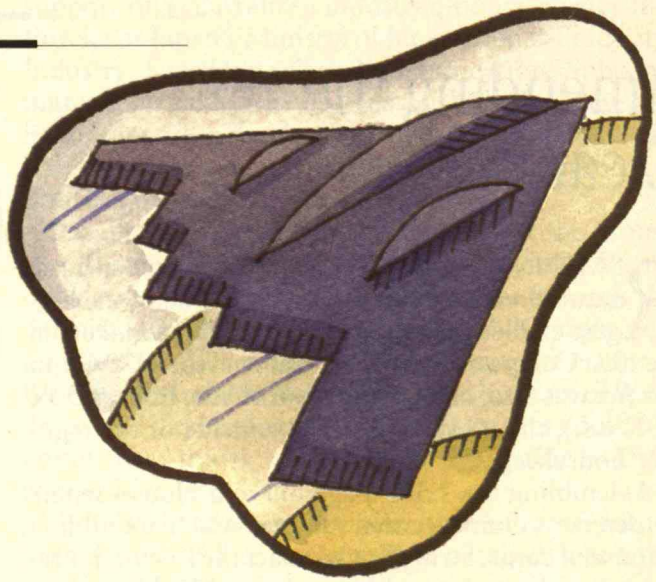
Getting the legislation this far was a feat. For seven years, Energy and Commerce Committee chair John Dingell (D-Mich.) had blocked House attempts to pass acid-rain laws. In 1988, a last-minute Senate compromise on the issue fell apart under criticism from both environmentalists and the utility and coal industries.

When Sen. George Mitchell (D-Maine), a strong supporter of Clean Air Act amendments, became majority leader last year and Bush unveiled the administration's clean-air proposals, the logjam appeared about to break. But the legislation affects so many different interests that negotiations have hardly flowed smoothly.

One of the most contentious points—and one of few clean-air disputes to divide Congress along party lines—concerns jobs. A showdown came in March, when Robert Byrd (D-W.Va.) forced the Senate to vote on whether to provide $500 million in benefits to coal miners who would be displaced by the bill's provisions. Bush had promised to veto any legislation containing such benefits, and the amendment lost, 49 to 50, after White House pressure wrested away two pro-labor votes. But the House counterpart would extend 26 weeks of unemployment benefits to workers who lose their jobs because of clean-air restrictions. If that clause survives in conference, Democrats say they are confident that Bush will sign the law rather than veto an environmental bill close to the November election.

Proponents of a strengthened Clean Air Act have worried that the closer the slow-moving conference comes to a deadline, the more vulnerable the bill is to disembowelment. But a powerful environmental coalition in Congress and memories of 1976, when two years of work evaporated in an eleventh-hour filibuster, remain, and lobbyists like Diane Smiroldo of the Edison Electrical Institute accept that polluters will soon face tougher clean-air standards. Says Smiroldo, "It's hard to believe that anybody would want to have to come back in the 102nd Congress and start from scratch."

# Funding the B-2 Bomber



THE B-2 stealth bomber may hide from the most sophisticated air defenses, but the bat-winged plane is less agile at evading Congress. If House conferees have their way, a showdown with the Senate on the Pentagon budget will end with the shoot-down of the costly craft. The battle tests congressional will to curb spending on exotic military technologies of debated usefulness.

B-2 opponents have seen their ranks swell as the diminishing Soviet military threat and the ballooning cost of the bomber—currently $840 million per plane—have weakened the logic that sustained the program through the 1980s. "If the threats we face internationally were greater and the deficits we face at home were smaller, we might continue to hedge with the B-2," declared influential House Armed Services Committee chair and former stealth proponent Les Aspin (D-Wis.), in July. "But they aren't and we can't."

Sen. Sam Nunn (D-Ga.), who is just as powerful, counters that to end B-2 production would waste $35.4 billion already spent. And it would seriously jeopardize the "strategic triad" of bombers, ICBMs, and submarine-launched missiles that underlies U.S. nuclear deterrence. The Pentagon says the B-2 is needed for "penetrating" bombing missions against mobile missiles and control centers deep within the Soviet Union, where increasingly sophisticated air defenses will soon outmode the old B-52 and even the relatively new B-1B bombers.

Congressional skepticism about the B-2 has been building for over a year, stemming largely from the $70 billion price tag for the 132 bombers originally requested by the Air Force. Last year's attempts in both cham-

bers to cut off stealth spending failed, and the B-2's allocation was just $444 million under the $3.99 billion the administration requested. But when Aspin switched sides, B-2 opponents gained heavy firepower. According to Michael Brower, a physicist and arms analyst with the liberal Union of Concerned Scientists, the senator could abandon the B-2 because "the atmosphere has completely changed" on military spending since the Reagan years. "It's become more respectable to be less pro-military."

To some extent, Pat Glynn, a resident scholar at the conservative American Enterprise Institute in Washington, would agree with that analysis. "This would never have happened under Reagan," thinks Glynn. He diagnoses a flagging of national purpose when it comes to ambitious technological projects like the B-2. That sense of purpose "could be restored very easily, but the key is leadership and this administration is offering virtually no leadership."

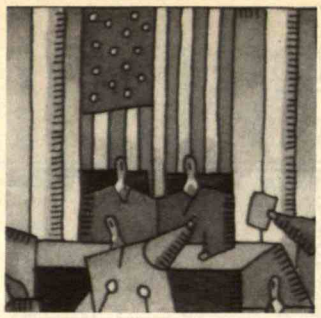
But Brower doubts that the B-2 votes mean the United States has lost its gusto for big-ticket technology in general. If it had, "We would probably see the evidence in congressional opposition to the Superconducting Super Collider and similar massive projects," Brower says.

One reason for the failing health of stealth might simply be that its pork is concentrated—most B-2 contracts go to only five states. Defense industry analysts have warned that canceling the B-2 could put its prime contractor, Northrop Corp., out of business, but in the current atmosphere, says Brower, Capitol Hill "can now point to reducing the federal deficit as a higher priority than protecting constituents' jobs."

Since August, B-2 supporters have stressed another argument for keeping production on track. A halt, they say, would deprive the Air Force of a versatile weapon for regional conventional conflicts. Iraq's August invasion of Kuwait, one day before a key Senate vote, helped save the bomber, at least temporarily. The upper chamber defeated, 53 to 45, a move to limit the Pentagon to completing only 15 planes, rather than the president's proposed 75. Two days earlier, Aspin's House committee had voted to delete the B-2 from the House defense budget authorization. Still, even two months into the Mid-East crisis, the full House went along with its committee by a vote of 256 to 155. The narrow Senate margin leaves the House well-positioned for conference negotiations.

B-2 flight tests continue over the California desert at Edwards Air Force Base, but the real test of the bomber will be whether it can fly on Capitol Hill. With deficits far above Gramm-Rudman-Hollings limits, big weapons are an inevitable target for cost-cutters. The 101st Congress has Mikhail Gorbachev to thank for reducing the political sting.

*"NASA Budget" on page 69*



## Senate Votes

**Math and Science Education Programs**
S 695, President Bush's "Excellence in Education Act," includes $5 million for a National Science Scholars program. Passed 92-8 on February 7, 1990; R 37-8, D 55-0.

**Clean Air Act Amendment on Benefits for Coal Miners**
An amendment to S 1630 offered by Robert Byrd (D-W.Va.) would have provided $500 million in severance pay and retraining benefits for coal miners displaced by new acid-rain controls. Rejected 49-50 on March 29, 1990; R 11-34, D 38-16.

**Clean Air Act Reauthorization**
S 1630 amends the Clean Air Act to require "maximum achievable" pollution-control technology, limit automobile emissions, reduce urban smog and acid rain, and otherwise protect the atmosphere. Passed 89-11 on April 3, 1990; R 39-6, D 50-5.

**B-2 Stealth Bomber Authorization**
An amendment to S 2884 would have eliminated $1.812 billion in procurement funds for two B-2 bombers in 1991, limiting the Pentagon to completing 15 planes instead of the proposed 75. Rejected 45-53 on Aug. 2, 1990; R 9-34, D 36-19.

**Superconducting Super Collider Authorization**
HR 5019 appropriates $20.8 billion for energy and water programs, including $318 million for the atom smasher. Passed by voice vote on August 2, 1990.

**Technology Programs Authorization**
S 1191 authorizes $320 million in FY 1990 funds for research on high-definition television and other new technologies through the Advanced Technology Program of the National Institute of Standards and Technology. Passed by voice vote on October 26, 1989.

## House Votes

**Superconducting Super Collider Authorization**
HR 4380 limits federal spending on the advanced atom smasher to $5 billion, with $2.4 billion more to come from Texas and foreign sources. Passed 309-109 on May 2, 1990; R 115-57, D 194-52.

**Math and Science Education Amendments**
HR 5115 authorizes $1.1 billion in FY 1991-95 for congressional science scholarships and other education reforms. Passed 350-25 on July 20, 1990; R 123-25, D 227-0.

**Technology Programs Authorization**
HR 4329 funds the National Institute of Standards and Technology through 1992, including $100 million in FY 1991 and $250 million in FY 1992 for research on high-definition television and other new technologies under the Advanced Technology Program. Passed 327-93 on July 11, 1990; R 83-90, D 244-3.

**Clean Air Act Reauthorization**
HR 3030 amends the Clean Air Act to limit automobile emissions, reduce urban smog and acid rain, require "maximum achievable" control technology by industrial polluters, and otherwise protect the atmosphere. Passed 401-21 on May 23, 1990; R 154-16, D 247-5.

**B-2 Stealth Bomber Cancellation**
HR 4379 authorizes $283 billion in FY 1991 military spending, limiting B-2 bomber production to the 15 planes previously funded. Passed 256-155 on September 19, 1990; R 33-135, D 223-20.

**NASA Funding**
HR 5158 appropriates $83.6 billion in FY 1991 for HUD, the Department of Veterans' Affairs, and independent agencies, including $14.3 billion for NASA. Passed 355-48 on June 28, 1990; R 128-39, D 227-9.

| KEY | | | | |
|---|---|---|---|---|
| | Y | Voted for (yea) | + | Announced for |
| | N | Voted against (nay) | - | Announced against |
| | # | Paired for | P | Voted "present" |
| | X | Paired against | ? | Did not vote |

Democrats are in roman. Republicans are in italics. These tables are for informational purposes only, and are not intended to express endorsement of, or opposition to, any member of Congress.

# Senate

| | EDUCATION | AIR: MINERS | AIR: PASSAGE | B-2 | COLLIDER | TECH POLICY |
|---|---|---|---|---|---|---|
| **ALABAMA** | | | | | VOICE VOTE TAKEN | |
| Heflin | Y | Y | Y | N | | |
| Shelby | Y | Y | Y | N | | |
| **ALASKA** | | | | | | |
| *Murkowski* | Y | N | Y | N | | |
| *Stevens* | Y | Y | Y | N | | |
| **ARIZONA** | | | | | | |
| DeConcini | Y | Y | Y | Y | | |
| *McCain* | Y | N | Y | Y | | |
| **ARKANSAS** | | | | | | |
| Bumpers | Y | Y | Y | Y | | |
| Pryor | Y | N | Y | Y | | |
| **CALIFORNIA** | | | | | | |
| Cranston | Y | Y | Y | Y | | |
| *Wilson* | Y | N | Y | X | | |
| **COLORADO** | | | | | | |
| Wirth | Y | Y | Y | Y | | |
| *Armstrong* | N | N | Y | N | | |
| **CONNECTICUT** | | | | | | |
| Dodd | Y | N | Y | N | | |
| Lieberman | Y | Y | Y | Y | | |
| **DELAWARE** | | | | | | |
| Biden | Y | N | Y | Y | | |
| *Roth* | Y | N | Y | N | | |
| **FLORIDA** | | | | | | |
| Graham | Y | N | Y | N | | |
| *Mack* | Y | N | Y | N | | |
| **GEORGIA** | | | | | | |
| Fowler | Y | N | Y | N | | |
| Nunn | Y | N | Y | N | | |
| **HAWAII** | | | | | | |
| Inouye | Y | Y | Y | N | | |
| Akaka | Y | Y | Y | Y | | |
| **IDAHO** | | | | | | |
| *McClure* | N | Y | N | N | | |
| *Symms* | N | N | N | N | | |
| **ILLINOIS** | | | | | | |
| Dixon | Y | Y | N | N | | |
| Simon | Y | Y | N | Y | | |
| **INDIANA** | | | | | | |
| *Coats* | Y | Y | Y | N | | |
| *Lugar* | Y | N | Y | N | | |
| **IOWA** | | | | | | |
| Harkin | Y | Y | Y | Y | | |
| *Grassley* | Y | Y | Y | N | | |
| **KANSAS** | | | | | | |
| *Dole* | Y | N | Y | N | | |
| *Kassebaum* | Y | N | Y | N | | |
| **KENTUCKY** | | | | | | |
| Ford | Y | Y | Y | N | | |
| *McConnell* | Y | Y | Y | N | | |
| **LOUISIANA** | | | | | | |
| Breaux | Y | N | Y | N | | |
| Johnston | Y | + | Y | N | | |
| **MAINE** | | | | | | |
| Mitchell | Y | N | Y | Y | | |
| *Cohen* | Y | N | Y | Y | | |
| **MARYLAND** | | | | | | |
| Mikulski | Y | Y | Y | Y | | |
| Sarbanes | Y | N | Y | Y | | |
| **MASSACHUSETTS** | | | | | | |
| Kennedy | Y | Y | Y | Y | | |
| Kerry | Y | Y | Y | Y | | |
| **MICHIGAN** | | | | | | |
| Levin | Y | N | Y | Y | | |
| Riegle | Y | N | Y | Y | | |
| **MINNESOTA** | | | | | | |
| *Boschwitz* | Y | N | Y | N | | |
| *Durenberger* | Y | N | Y | N | | |

| | EDUCATION | AIR: MINERS | AIR: PASSAGE | B-2 | COLLIDER | TECH POLICY |
|---|---|---|---|---|---|---|
| **MISSISSIPPI** | | | | | VOICE VOTE TAKEN | |
| *Cochran* | Y | Y | Y | N | | |
| *Lott* | Y | N | Y | N | | |
| **MISSOURI** | | | | | | |
| *Bond* | Y | Y | Y | N | | |
| *Danforth* | Y | Y | Y | N | | |
| **MONTANA** | | | | | | |
| Baucus | Y | N | Y | Y | | |
| *Burns* | Y | N | Y | N | | |
| **NEBRASKA** | | | | | | |
| Exon | Y | Y | Y | N | | |
| Kerrey | Y | Y | Y | N | | |
| **NEVADA** | | | | | | |
| Bryan | Y | Y | Y | N | | |
| Reid | Y | Y | Y | Y | | |
| **NEW HAMPSHIRE** | | | | | | |
| *Humphrey* | N | N | Y | N | | |
| *Rudman* | Y | N | Y | N | | |
| **NEW JERSEY** | | | | | | |
| Bradley | Y | Y | Y | Y | | |
| Lautenberg | Y | Y | Y | Y | | |
| **NEW MEXICO** | | | | | | |
| Bingaman | Y | Y | Y | Y | | |
| *Domenici* | Y | N | Y | N | | |
| **NEW YORK** | | | | | | |
| Moynihan | Y | Y | Y | Y | | |
| *D'Amato* | Y | N | Y | Y | | |
| **NORTH CAROLINA** | | | | | | |
| Sanford | Y | Y | Y | N | | |
| *Helms* | N | N | N | N | | |
| **NORTH DAKOTA** | | | | | | |
| Burdick | Y | Y | Y | Y | | |
| Conrad | Y | Y | Y | Y | | |
| **OHIO** | | | | | | |
| Glenn | Y | Y | N | Y | | |
| Metzenbaum | Y | Y | Y | Y | | |
| **OKLAHOMA** | | | | | | |
| Boren | Y | N | Y | N | | |
| *Nickles* | Y | N | N | N | | |
| **OREGON** | | | | | | |
| *Hatfield* | Y | Y | Y | Y | | |
| *Packwood* | Y | N | Y | Y | | |
| **PENNSYLVANIA** | | | | | | |
| *Heinz* | Y | Y | Y | Y | | |
| *Specter* | Y | Y | Y | Y | | |
| **RHODE ISLAND** | | | | | | |
| Pell | Y | Y | Y | Y | | |
| *Chafee* | Y | N | Y | Y | | |
| **SOUTH CAROLINA** | | | | | | |
| Hollings | Y | Y | Y | Y | | |
| *Thurmond* | Y | N | Y | N | | |
| **SOUTH DAKOTA** | | | | | | |
| Daschle | Y | N | Y | Y | | |
| *Pressler* | Y | N | Y | Y | | |
| **TENNESSEE** | | | | | | |
| Gore | Y | Y | Y | N | | |
| Sasser | Y | Y | Y | Y | | |
| **TEXAS** | | | | | | |
| Bentsen | Y | Y | Y | N | | |
| *Gramm* | N | N | Y | N | | |
| **UTAH** | | | | | | |
| *Garn* | N | N | N | N | | |
| *Hatch* | Y | N | Y | N | | |
| **VERMONT** | | | | | | |
| Leahy | Y | N | Y | Y | | |
| *Jeffords* | Y | N | Y | # | | |
| **VIRGINIA** | | | | | | |
| Robb | Y | N | Y | N | | |
| *Warner* | Y | N | Y | N | | |

| | EDUCATION | AIR: MINERS | AIR: PASSAGE | B-2 | COLLIDER | TECH POLICY |
|---|---|---|---|---|---|---|
| **WASHINGTON** | | | | | VOICE VOTE TAKEN | |
| Adams | Y | Y | Y | Y | | |
| *Gorton* | Y | N | Y | N | | |
| **WEST VIRGINIA** | | | | | | |
| Byrd | Y | Y | N | Y | | |
| Rockefeller | Y | Y | N | Y | | |
| **WISCONSIN** | | | | | | |
| Kohl | Y | Y | Y | Y | | |
| *Kasten* | Y | N | Y | N | | |
| **WYOMING** | | | | | | |
| *Simpson* | Y | N | Y | N | | |
| *Wallop* | N | N | N | N | | |

# House

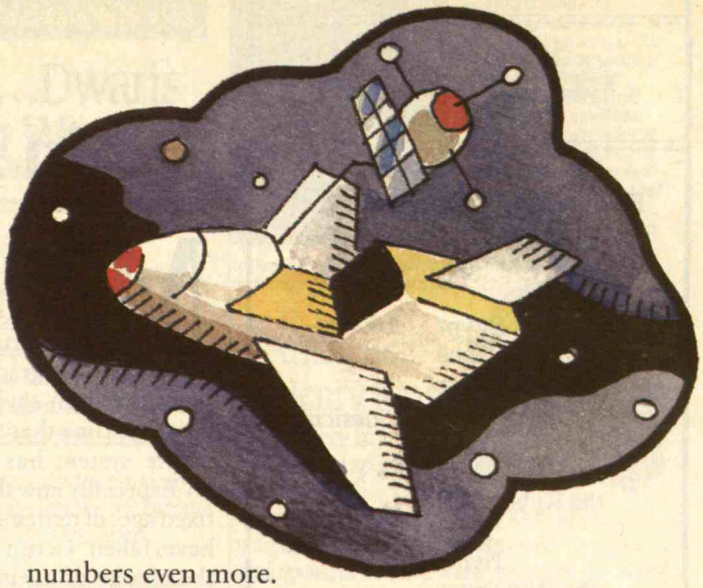
| | COLLIDER | EDUCATION | TECH POLICY | CLEAN AIR | B-2 | NASA |
|---|---|---|---|---|---|---|
| **ALABAMA** | | | | | | |
| *Callahan* | Y | ? | Y | Y | N | Y |
| *Dickinson* | Y | Y | Y | Y | N | Y |
| Browder | Y | Y | Y | Y | Y | Y |
| Bevill | Y | Y | Y | Y | Y | Y |
| Flippo | ? | Y | Y | ? | Y | Y |
| Erdreich | Y | Y | Y | Y | Y | Y |
| Harris | Y | Y | Y | Y | Y | Y |
| **ALASKA** | | | | | | |
| *Young* | Y | Y | Y | Y | N | Y |
| **ARIZONA** | | | | | | |
| *Rhodes* | Y | N | N | Y | N | Y |
| Udall | Y | Y | Y | Y | Y | Y |
| *Stump* | Y | - | N | N | N | N |
| *Kyl* | ? | N | N | Y | N | N |
| *Kolbe* | Y | Y | N | Y | N | Y |
| **ARKANSAS** | | | | | | |
| Alexander | Y | Y | Y | ? | Y | Y |
| *Robinson* | Y | ? | Y | ? | X | ? |
| *Hammerschmidt* | Y | Y | Y | Y | N | Y |
| Anthony | Y | Y | Y | Y | Y | Y |
| **CALIFORNIA** | | | | | | |
| Bosco | Y | Y | Y | Y | Y | Y |
| *Herger* | N | N | N | Y | N | N |
| Matsui | Y | Y | Y | Y | ? | Y |
| Fazio | Y | Y | Y | Y | Y | Y |
| Pelosi | Y | Y | Y | Y | Y | Y |
| Boxer | Y | ? | Y | Y | ? | Y |
| Miller | N | ? | Y | Y | Y | Y |
| Dellums | Y | Y | Y | Y | N | Y |
| Stark | N | Y | Y | Y | Y | ? |
| Edwards | Y | Y | Y | Y | N | Y |
| Lantos | Y | Y | Y | Y | Y | Y |
| *Campbell* | N | Y | Y | Y | N | N |
| Mineta | Y | Y | Y | Y | Y | Y |
| *Shumway* | Y | N | N | Y | N | N |
| Condit | Y | Y | Y | Y | Y | P |
| Panetta | Y | Y | Y | Y | Y | Y |
| *Pashayan* | Y | Y | Y | Y | N | Y |
| Lehman | Y | Y | Y | Y | Y | Y |
| *Lagomarsino* | Y | Y | N | Y | N | Y |
| *Thomas* | Y | ? | N | ? | N | Y |
| *Gallegly* | Y | Y | N | Y | N | Y |
| *Moorhead* | Y | Y | N | Y | N | N |
| Beilenson | N | Y | Y | Y | Y | N |
| Waxman | Y | ? | Y | Y | Y | Y |
| Roybal | Y | Y | Y | Y | N | Y |
| Berman | Y | Y | Y | Y | Y | Y |
| Levine | ? | Y | Y | Y | Y | Y |
| Dixon | Y | Y | Y | Y | Y | Y |

| | COLLIDER | EDUCATION | TECH POLICY | CLEAN AIR | B-2 | NASA |
|---|---|---|---|---|---|---|
| Hawkins | Y | Y | Y | Y | Y | Y |
| Martinez | Y | Y | Y | Y | Y | ? |
| Dymally | Y | Y | Y | Y | Y | Y |
| Anderson | Y | Y | Y | Y | Y | Y |
| *Dreier* | Y | Y | N | Y | N | Y |
| Torres | Y | Y | Y | Y | Y | Y |
| *Lewis* | Y | ? | Y | Y | N | # |
| Brown | Y | Y | Y | Y | Y | Y |
| *McCandless* | Y | Y | N | Y | N | Y |
| *Dornan* | Y | ? | N | Y | N | Y |
| *Dannemeyer* | Y | ? | N | N | N | N |
| *Cox* | Y | ? | N | Y | N | N |
| *Lowery* | Y | Y | Y | Y | N | Y |
| *Rohrabacher* | N | N | N | Y | N | N |
| *Packard* | Y | ? | N | Y | N | N |
| Bates | N | Y | Y | Y | Y | Y |
| *Hunter* | Y | N | N | Y | N | Y |
| **COLORADO** | | | | | | |
| Schroeder | N | Y | Y | Y | Y | Y |
| Skaggs | Y | Y | Y | Y | Y | Y |
| Campbell | Y | Y | Y | Y | Y | Y |
| *Brown* | Y | Y | N | Y | N | Y |
| *Hefley* | N | Y | N | Y | N | Y |
| *Schaefer* | Y | Y | N | Y | N | Y |
| **CONNECTICUT** | | | | | | |
| Kennelly | Y | Y | Y | Y | Y | Y |
| Gejdenson | Y | Y | Y | Y | Y | Y |
| Morrison | N | + | ? | Y | Y | ? |
| *Shays* | N | Y | Y | Y | Y | Y |
| *Rowland* | N | ? | Y | Y | Y | Y |
| *Johnson* | N | Y | Y | Y | N | N |
| **DELAWARE** | | | | | | |
| Carper | N | Y | Y | Y | Y | Y |
| **FLORIDA** | | | | | | |
| Hutto | Y | Y | Y | Y | Y | Y |
| *Grant* | Y | Y | Y | Y | N | Y |
| Bennett | Y | Y | Y | Y | Y | Y |
| *James* | N | Y | N | Y | Y | Y |
| *McCollum* | Y | ? | Y | Y | N | Y |
| *Stearns* | Y | Y | N | Y | N | Y |
| Gibbons | Y | Y | Y | Y | Y | Y |
| *Young* | Y | Y | Y | Y | N | Y |
| *Bilirakis* | Y | Y | Y | Y | ? | Y |
| *Ireland* | Y | Y | N | Y | # | Y |
| Nelson | + | + | ? | + | Y | # |
| *Lewis* | Y | Y | Y | Y | N | Y |
| *Goss* | Y | Y | N | Y | N | Y |
| Johnston | Y | Y | Y | Y | Y | Y |
| *Shaw* | Y | Y | N | Y | N | Y |
| Smith | ? | Y | Y | Y | ? | ? |
| Lehman | Y | Y | Y | Y | Y | Y |
| *Ros-Lehtinen* | N | Y | Y | Y | N | Y |
| Fascell | Y | Y | Y | Y | Y | Y |
| **GEORGIA** | | | | | | |
| Thomas | Y | Y | Y | Y | Y | Y |
| Hatcher | Y | Y | Y | Y | Y | Y |
| Ray | Y | Y | Y | Y | Y | Y |
| Jones | Y | Y | Y | Y | Y | Y |
| Lewis | Y | Y | Y | Y | N | Y |
| *Gingrich* | Y | Y | N | Y | N | Y |
| Darden | Y | Y | Y | Y | Y | Y |
| Rowland | Y | Y | Y | Y | Y | Y |
| Jenkins | Y | Y | ? | Y | Y | ? |
| Barnard | Y | ? | Y | Y | Y | Y |
| **HAWAII** | | | | | | |
| *Saiki* | Y | Y | Y | Y | Y | Y |
| Akaka | Y | | | | | |
| **IDAHO** | | | | | | |
| *Craig* | X | ? | N | Y | N | Y |
| Stallings | Y | ? | Y | Y | Y | Y |
| **ILLINOIS** | | | | | | |
| Hayes | Y | Y | Y | Y | N | Y |
| Savage | Y | Y | Y | Y | N | Y |
| Russo | Y | Y | Y | Y | Y | N |
| Sangmeister | Y | Y | Y | Y | Y | Y |
| Lipinsky | Y | Y | Y | Y | Y | Y |
| *Hyde* | N | Y | Y | Y | N | Y |
| Collins | ? | Y | Y | Y | N | Y |
| Rostenkowski | N | Y | Y | Y | Y | Y |
| Yates | Y | Y | Y | Y | ? | Y |
| *Porter* | N | + | N | Y | Y | Y |
| Annunzio | Y | Y | Y | Y | Y | Y |
| *Crane* | N | N | N | N | N | N |
| *Fawell* | Y | Y | Y | Y | N | N |
| *Hastert* | N | Y | N | Y | N | Y |
| *Madigan* | Y | Y | N | Y | N | Y |
| *Martin* | Y | Y | Y | Y | N | X |
| Evans | N | Y | Y | Y | Y | Y |
| *Michel* | Y | Y | N | Y | N | N |
| Bruce | Y | Y | Y | Y | Y | Y |
| Durbin | N | Y | Y | Y | Y | Y |
| Costello | Y | Y | Y | N | Y | Y |
| Poshard | Y | Y | Y | N | Y | Y |
| **INDIANA** | | | | | | |
| Visclosky | Y | ? | Y | Y | Y | Y |
| Sharp | N | Y | Y | Y | Y | Y |
| *Hiler* | N | Y | N | Y | N | Y |
| Long | N | Y | Y | Y | Y | Y |
| Jontz | N | Y | Y | Y | Y | Y |
| *Burton* | N | N | N | N | N | Y |
| *Myers* | Y | ? | Y | N | N | Y |
| McCloskey | Y | Y | Y | Y | Y | Y |
| Hamilton | N | Y | Y | Y | Y | Y |
| Jacobs | N | Y | N | Y | Y | N |
| **IOWA** | | | | | | |
| *Leach* | Y | Y | Y | Y | Y | Y |
| *Tauke* | N | Y | Y | Y | N | N |
| Nagle | Y | Y | Y | Y | Y | Y |
| Smith | Y | ? | Y | Y | Y | Y |
| *Lightfoot* | ? | N | N | N | N | Y |
| *Grandy* | N | Y | N | Y | N | Y |
| **KANSAS** | | | | | | |
| *Roberts* | Y | Y | N | Y | N | N |
| Slattery | N | Y | Y | Y | Y | Y |
| *Meyers* | Y | Y | Y | Y | N | Y |
| Glickman | N | Y | Y | Y | Y | Y |
| *Whittaker* | Y | Y | Y | Y | N | Y |
| **KENTUCKY** | | | | | | |
| Hubbard | Y | Y | Y | N | Y | Y |
| Natcher | Y | Y | Y | Y | Y | Y |
| Mazzoli | Y | Y | Y | Y | Y | Y |
| *Bunning* | N | Y | N | Y | N | N |
| *Rogers* | Y | Y | Y | Y | N | Y |
| *Hopkins* | Y | Y | Y | Y | Y | N |
| Perkins | Y | Y | Y | Y | Y | Y |
| **LOUISIANA** | | | | | | |
| *Livingston* | Y | Y | Y | Y | N | Y |
| Boggs | Y | ? | Y | Y | Y | Y |
| Tauzin | Y | ? | Y | Y | Y | Y |
| *McCrery* | Y | Y | N | Y | N | Y |
| Huckaby | ? | Y | Y | Y | Y | Y |
| *Baker* | Y | ? | Y | Y | N | Y |
| Hayes | Y | ? | Y | Y | Y | Y |
| *Holloway* | Y | Y | N | ? | N | Y |
| **MAINE** | | | | | | |
| Brennan | Y | Y | Y | Y | Y | Y |
| *Snowe* | N | Y | Y | Y | Y | Y |
| **MARYLAND** | | | | | | |
| Dyson | N | ? | Y | Y | Y | P |
| *Bentley* | Y | ? | Y | Y | N | Y |
| Cardin | Y | Y | Y | Y | Y | Y |
| McMillen | Y | Y | Y | Y | Y | Y |
| Hoyer | Y | Y | Y | Y | Y | Y |
| Byron | Y | Y | Y | Y | Y | N |
| Mfume | Y | Y | Y | Y | Y | Y |
| *Morella* | Y | Y | Y | Y | Y | Y |
| **MASSACHUSETTS** | | | | | | |
| *Conte* | Y | Y | Y | Y | Y | Y |
| Neal | Y | Y | Y | Y | Y | Y |
| Early | N | ? | Y | Y | Y | Y |
| Frank | Y | Y | Y | Y | ? | Y |
| Atkins | Y | Y | Y | Y | Y | Y |
| Mavroules | Y | Y | Y | Y | Y | Y |
| Markey | Y | Y | Y | Y | Y | Y |
| Kennedy | Y | Y | Y | Y | Y | Y |
| Moakley | Y | Y | Y | Y | Y | Y |
| Studds | N | Y | Y | Y | Y | Y |
| Donnelly | Y | Y | Y | Y | Y | ? |
| **MICHIGAN** | | | | | | |
| Conyers | Y | Y | Y | Y | N | ? |
| *Pursell* | Y | Y | Y | Y | X | Y |
| Wolpe | N | Y | Y | Y | Y | Y |
| *Upton* | N | Y | N | Y | N | N |
| *Henry* | N | Y | Y | Y | N | N |
| Carr | N | Y | Y | Y | Y | Y |
| Kildee | N | Y | Y | Y | Y | Y |
| Traxler | Y | Y | Y | Y | ? | Y |
| *Vander Jagt* | N | Y | Y | Y | N | Y |
| *Schuette* | N | ? | Y | Y | N | ? |
| *Davis* | N | ? | Y | Y | N | Y |
| Bonior | N | Y | Y | Y | Y | Y |
| Crockett | N | Y | ? | Y | N | ? |
| Hertel | N | Y | Y | Y | Y | Y |
| Ford | Y | Y | Y | Y | Y | Y |
| Dingell | Y | Y | Y | Y | Y | Y |
| Levin | Y | Y | Y | Y | Y | Y |
| *Broomfield* | N | ? | Y | Y | N | Y |
| **MINNESOTA** | | | | | | |
| Penny | N | Y | Y | Y | Y | N |
| *Weber* | Y | Y | N | Y | N | Y |
| *Frenzel* | N | Y | N | ? | N | N |
| Vento | N | Y | Y | Y | Y | Y |
| Sabo | Y | Y | Y | Y | Y | Y |
| Sikorski | N | Y | Y | Y | Y | Y |
| *Stangeland* | N | Y | Y | Y | N | Y |
| Oberstar | N | Y | Y | Y | Y | Y |
| **MISSISSIPPI** | | | | | | |
| Whitten | Y | Y | Y | Y | Y | Y |
| Espy | Y | ? | Y | Y | Y | Y |
| Montgomery | Y | Y | Y | Y | Y | Y |
| Parker | Y | Y | Y | Y | Y | Y |
| Taylor | Y | Y | Y | Y | Y | Y |
| **MISSOURI** | | | | | | |
| Clay | Y | Y | Y | Y | N | Y |
| *Buechner* | N | Y | Y | Y | Y | Y |
| Gephardt | Y | ? | Y | Y | Y | Y |
| Skelton | Y | Y | Y | Y | Y | Y |
| Wheat | Y | Y | Y | Y | Y | Y |
| *Coleman* | Y | Y | Y | Y | N | Y |
| *Hancock* | N | N | N | N | N | N |
| *Emerson* | Y | Y | Y | Y | Y | Y |
| Volkmer | Y | Y | Y | Y | Y | Y |
| **MONTANA** | | | | | | |
| Williams | N | Y | Y | Y | N | N |
| *Marlenee* | N | Y | N | N | N | Y |
| **NEBRASKA** | | | | | | |
| *Bereuter* | N | Y | Y | Y | N | Y |
| Hoagland | N | Y | Y | Y | Y | Y |
| *Smith* | Y | ? | Y | Y | N | Y |
| **NEVADA** | | | | | | |
| Bilbray | Y | Y | Y | Y | Y | Y |
| *Vucanovich* | Y | + | N | Y | N | Y |
| **NEW HAMPSHIRE** | | | | | | |
| *Smith, R.* | N | N | N | Y | N | N |
| *Douglas* | N | N | N | Y | N | N |
| **NEW JERSEY** | | | | | | |
| Hughes | Y | Y | Y | Y | Y | Y |
| Pallone | Y | Y | Y | Y | Y | Y |

# House

| | COLLIDER | EDUCATION | TECH POLICY | CLEAN AIR | B-2 | NASA |
|---|---|---|---|---|---|---|
| *Smith* | Y | Y | Y | Y | Y | Y |
| *Roukema* | N | N | Y | Y | Y | Y |
| Dwyer | Y | ? | Y | Y | Y | Y |
| *Rinaldo* | Y | Y | Y | Y | N | Y |
| Roe | Y | Y | Y | Y | Y | Y |
| Torricelli | Y | Y | Y | Y | Y | Y |
| Payne | Y | Y | Y | Y | N | Y |
| *Gallo* | Y | Y | Y | Y | N | Y |
| *Courter* | Y | ? | Y | Y | N | Y |
| *Saxton* | Y | Y | Y | Y | N | Y |
| Guarini | Y | Y | Y | Y | Y | Y |
| **NEW MEXICO** | | | | | | |
| *Schiff* | Y | Y | Y | Y | N | Y |
| *Skeen* | Y | Y | N | Y | N | Y |
| Richardson | Y | Y | Y | Y | Y | Y |
| **NEW YORK** | | | | | | |
| Hochbrueckner | Y | Y | Y | Y | Y | Y |
| Downey | Y | Y | Y | Y | Y | Y |
| Mrazek | Y | ? | Y | Y | Y | Y |
| *Lent* | Y | Y | N | Y | N | Y |
| *McGrath* | Y | Y | N | Y | Y | Y |
| Flake | Y | Y | Y | Y | N | Y |
| Ackerman | ? | Y | ? | Y | Y | Y |
| Scheuer | Y | Y | Y | Y | Y | Y |
| Manton | Y | Y | Y | Y | Y | ? |
| Schumer | Y | Y | Y | Y | ? | Y |
| Towns | Y | Y | Y | Y | ? | Y |
| Owens | Y | Y | Y | Y | N | Y |
| Solarz | Y | Y | Y | Y | Y | Y |
| *Molinari* | Y | Y | Y | Y | N | Y |
| *Green* | Y | Y | Y | Y | Y | Y |
| Rangel | # | Y | Y | Y | N | Y |
| Weiss | N | Y | Y | Y | Y | Y |
| Serrano | Y | Y | Y | Y | N | Y |
| Engel | Y | Y | Y | Y | Y | Y |
| Lowey | Y | Y | Y | Y | Y | Y |
| *Fish* | Y | Y | ? | Y | N | Y |
| *Gilman* | Y | Y | Y | Y | Y | Y |
| McNulty | Y | Y | Y | Y | Y | Y |
| *Solomon* | N | Y | N | Y | Y | Y |
| *Boehlert* | Y | Y | Y | Y | Y | Y |
| *Martin* | N | ? | Y | Y | N | Y |
| *Walsh* | Y | Y | Y | Y | N | Y |
| McHugh | Y | Y | Y | Y | Y | Y |
| *Horton* | Y | Y | Y | Y | # | Y |
| Slaughter | Y | Y | Y | Y | Y | Y |
| *Paxon* | N | Y | N | Y | N | Y |
| LaFalce | N | Y | Y | Y | Y | Y |
| Nowak | Y | Y | Y | Y | Y | Y |
| *Houghton* | Y | Y | N | Y | Y | Y |
| **NORTH CAROLINA** | | | | | | |
| Jones | Y | Y | Y | Y | Y | Y |
| Valentine | Y | Y | Y | Y | Y | Y |
| Lancaster | Y | Y | Y | Y | Y | Y |
| Price | Y | Y | Y | Y | Y | Y |
| Neal | N | Y | N | Y | Y | Y |
| *Coble* | N | Y | N | Y | N | Y |
| Rose | Y | Y | Y | Y | Y | Y |
| Hefner | Y | Y | Y | Y | Y | Y |
| *McMillen* | Y | Y | N | Y | N | N |
| *Ballenger* | Y | N | N | Y | N | Y |
| Clarke | Y | Y | Y | Y | Y | Y |
| **NORTH DAKOTA** | | | | | | |
| Dorgan | Y | Y | Y | Y | Y | Y |
| **OHIO** | | | | | | |
| Luken | Y | Y | Y | Y | Y | ? |
| *Gradison* | N | Y | N | Y | N | N |
| Hall | Y | Y | Y | Y | Y | Y |
| *Oxley* | N | N | N | Y | N | Y |
| *Gillmor* | Y | ? | N | Y | N | Y |
| *McEwen* | N | ? | N | N | N | N |
| *DeWine* | Y | Y | Y | N | N | Y |
| *Lukens* | ? | N | ? | ? | N | ? |
| Kaptur | Y | Y | Y | Y | Y | P |
| *Miller* | Y | N | N | N | N | Y |
| Eckart | N | Y | Y | Y | Y | Y |
| *Kasich* | Y | Y | N | N | Y | Y |
| Pease | N | Y | Y | Y | Y | N |
| Sawyer | N | Y | Y | Y | Y | Y |
| *Wylie* | Y | Y | N | Y | N | Y |
| *Regula* | N | Y | N | Y | Y | Y |
| Traficant | Y | Y | Y | Y | N | Y |
| Applegate | Y | Y | Y | N | Y | Y |
| Feighan | Y | Y | Y | Y | Y | Y |
| Oakar | Y | Y | Y | Y | Y | Y |
| Stokes | Y | Y | Y | Y | N | Y |
| **OKLAHOMA** | | | | | | |
| *Inhofe* | Y | Y | N | Y | N | Y |
| Synar | N | ? | Y | Y | Y | Y |
| Watkins | Y | ? | Y | Y | ? | Y |
| McCurdy | Y | ? | Y | Y | Y | Y |
| *Edwards* | Y | Y | ? | Y | N | Y |
| English | Y | Y | Y | Y | Y | Y |
| **OREGON** | | | | | | |
| AuCoin | Y | Y | Y | Y | # | Y |
| *Smith, B.* | N | Y | Y | Y | N | Y |
| Wyden | Y | Y | Y | Y | Y | Y |
| DeFazio | N | Y | Y | Y | ? | Y |
| *Smith, D.* | Y | ? | N | Y | N | Y |
| **PENNSYLVANIA** | | | | | | |
| Foglietta | Y | Y | Y | Y | Y | Y |
| Gray | Y | Y | Y | Y | Y | Y |
| Borski | Y | Y | Y | Y | Y | Y |
| Kolter | Y | Y | Y | Y | Y | Y |
| *Schulze* | N | Y | Y | Y | N | ? |
| Yatron | Y | Y | Y | Y | Y | Y |
| *Weldon* | N | Y | Y | Y | Y | Y |
| Kostmayer | N | Y | Y | Y | Y | Y |
| *Shuster* | N | Y | N | N | N | N |
| *McDade* | Y | ? | Y | Y | X | Y |
| Kanjorski | N | Y | Y | Y | Y | Y |
| Murtha | Y | Y | Y | Y | Y | Y |
| *Coughlin* | N | Y | Y | Y | Y | Y |
| Coyne | Y | Y | Y | Y | Y | Y |
| *Ritter* | N | Y | Y | Y | ? | Y |
| *Walker* | Y | N | N | Y | N | N |
| *Gekas* | Y | N | N | Y | Y | N |
| Walgren | Y | Y | Y | Y | Y | Y |
| *Goodling* | Y | Y | Y | Y | N | Y |
| Gaydos | Y | Y | Y | Y | Y | Y |
| *Ridge* | N | Y | Y | Y | Y | Y |
| Murphy | N | Y | Y | Y | Y | Y |
| *Clinger* | Y | Y | Y | ? | N | Y |
| **RHODE ISLAND** | | | | | | |
| *Machtley* | N | Y | Y | Y | Y | Y |
| *Schneider* | N | Y | Y | Y | Y | Y |
| **SOUTH CAROLINA** | | | | | | |
| *Ravenel* | Y | Y | Y | Y | Y | Y |
| *Spence* | Y | Y | Y | Y | N | Y |
| Derrick | N | Y | ? | Y | Y | Y |
| Patterson | Y | Y | Y | Y | Y | Y |
| Spratt | N | Y | ? | Y | Y | Y |
| Tallon | N | Y | Y | Y | Y | Y |
| **SOUTH DAKOTA** | | | | | | |
| Johnson | Y | Y | Y | Y | Y | Y |
| **TENNESSEE** | | | | | | |
| *Quillen* | Y | Y | N | Y | X | Y |
| *Duncan* | N | Y | N | Y | N | N |
| Lloyd | Y | Y | Y | Y | Y | Y |
| Cooper | Y | Y | Y | Y | Y | Y |
| Clement | N | Y | Y | Y | Y | Y |
| Gordon | Y | Y | Y | Y | Y | Y |
| *Sundquist* | N | Y | N | Y | N | Y |
| Tanner | Y | Y | Y | Y | Y | Y |
| Ford | Y | ? | ? | Y | Y | Y |
| **TEXAS** | | | | | | |
| Chapman | Y | Y | Y | Y | Y | Y |
| Wilson | Y | Y | Y | Y | Y | ? |
| *Bartlett* | Y | Y | N | Y | N | N |
| Hall | Y | ? | ? | Y | Y | ? |
| Bryant | Y | Y | Y | Y | Y | Y |
| *Barton* | Y | Y | N | Y | N | ? |
| *Archer* | Y | Y | N | Y | N | N |
| *Fields* | Y | Y | N | Y | N | N |
| Brooks | Y | ? | Y | Y | Y | Y |
| Pickle | Y | ? | Y | Y | Y | ? |
| Leath | Y | Y | Y | ? | ? | Y |
| Geren | Y | Y | Y | Y | Y | Y |
| Sarpalius | Y | ? | Y | Y | Y | Y |
| Laughlin | Y | Y | Y | Y | Y | Y |
| de la Garza | Y | Y | Y | Y | Y | ? |
| Coleman | Y | Y | Y | Y | Y | Y |
| Stenholm | Y | Y | Y | Y | Y | Y |
| Washington | Y | Y | Y | Y | N | Y |
| *Combest* | Y | N | N | N | N | ? |
| Gonzalez | Y | Y | Y | Y | Y | Y |
| *Smith* | Y | Y | Y | Y | N | Y |
| *DeLay* | Y | N | N | N | N | N |
| Bustamante | Y | Y | Y | Y | Y | ? |
| Frost | Y | Y | Y | Y | Y | ? |
| Andrews | Y | Y | Y | Y | Y | Y |
| *Armey* | Y | N | N | N | N | N |
| Ortiz | Y | ? | Y | Y | Y | Y |
| **UTAH** | | | | | | |
| *Hansen* | Y | N | N | Y | N | Y |
| Owens | ? | Y | Y | Y | Y | Y |
| *Nielson* | Y | N | N | Y | N | X |
| **VERMONT** | | | | | | |
| *Smith, P.* | Y | Y | Y | Y | Y | Y |
| **VIRGINIA** | | | | | | |
| *Bateman* | Y | Y | Y | Y | Y | Y |
| Pickett | Y | Y | Y | Y | Y | N |
| *Bliley* | Y | Y | N | Y | N | Y |
| Sisisky | N | Y | Y | Y | Y | Y |
| Payne | N | Y | Y | Y | Y | Y |
| Olin | N | Y | N | Y | Y | N |
| *Slaughter* | Y | Y | N | Y | N | Y |
| *Parris* | Y | Y | Y | Y | N | Y |
| Boucher | Y | Y | Y | Y | Y | Y |
| *Wolf* | Y | Y | Y | Y | N | Y |
| **WASHINGTON** | | | | | | |
| *Miller* | Y | Y | Y | Y | N | Y |
| Swift | Y | Y | Y | Y | Y | Y |
| Unsoeld | Y | Y | Y | Y | # | Y |
| *Morrison* | Y | Y | Y | Y | N | Y |
| Foley | | | | | | |
| Dicks | Y | ? | Y | Y | Y | Y |
| McDermott | Y | ? | Y | Y | Y | Y |
| *Chandler* | Y | Y | Y | Y | N | Y |
| **WEST VIRGINIA** | | | | | | |
| Mollohan | Y | Y | Y | N | Y | Y |
| Staggers | Y | Y | Y | Y | Y | Y |
| Wise | Y | Y | Y | Y | Y | Y |
| Rahall | ? | Y | Y | Y | Y | Y |
| **WISCONSIN** | | | | | | |
| Aspin | Y | Y | Y | Y | Y | Y |
| Kastenmeier | N | Y | Y | Y | N | Y |
| *Gunderson* | N | Y | N | Y | N | Y |
| Kleczka | Y | Y | Y | Y | Y | Y |
| Moody | ? | Y | Y | Y | Y | Y |
| *Petri* | N | Y | N | Y | N | N |
| Obey | N | Y | Y | Y | Y | Y |
| *Roth* | Y | Y | N | Y | Y | Y |
| *Sensenbrenner* | N | N | N | Y | N | N |
| **WYOMING** | | | | | | |
| *Thomas* | N | ? | N | Y | Y | N |

# The NASA Budget



PRESIDENT Bush's dramatic proposal last year to send Americans to Mars by 2019 should have been a green light for the National Aeronautics and Space Administration, which has moved cautiously since its lustrous Apollo era ended in the early 1970s. Instead, NASA has been hobbled lately by vexing technical problems with the space shuttles, the Hubble Space Telescope, and the Magellan probe to Venus—and by the resulting skepticism about the agency's readiness to handle costly and complex missions. This summer, Congress slashed the funding requests for both the Moon-Mars initiative and *Space Station Freedom,* NASA's premier project.

NASA's summer run of embarrassing technical glitches triggered the ire of well-placed and normally pro-space legislators. "I don't like to use the word punishment, but somebody has to be held accountable," Bob Traxler (D-Mich.), chair of the House Appropriations Committee, told *Congressional Quarterly.* The Hubble debacle "dealt a devastating blow to NASA's credibility," declared Barbara Mikulski (D-Md.), chair of the Senate Appropriations subcommittee that oversees NASA, as she wondered whether the agency's plans for 1991 were affordable *or* achievable. "Any doubts about NASA's ability to manage the space program must be resolved before we can be secure in providing the many tens of billions of dollars that NASA is seeking to complete its present agenda," said Sen. Al Gore (D-Tenn.), chair of the Commerce Subcommittee on Science, Technology, and Space.

Amidst those doubts, House lawmakers still voted to grant the agency a 17 percent increase over its current $12.3 billion budget. But the bill eliminated the administration's $309 million request for Moon-Mars exploration. And Bush had put NASA in for a 23 percent raise.

The space agency took a big hit two weeks later when the Senate Appropriations Committee reduced discretionary spending for the subcommittee that oversees NASA—as well as NSF, EPA, the Department of Housing and Urban Development, and the Department of Veterans' Affairs—by $2.1 billion below the House figure. Most of the cut came out of the NSF and NASA budgets, which could drastically curtail the space-station program just when its schedule calls for bigger expenditures. The budget summit, where Congress and the White House are attempting to head off automatic Gramm-Rudman-Hollings reductions, may reduce the numbers even more.

A tightened space-station budget may mean another round in the cycle of delays, subsequent cost increases, cost-cutting redesigns, and new delays that have plagued the project since Congress first bought it in 1984. NASA has already spent half the original $8 billion price tag on design studies, and conservative estimates place the cost of *Freedom* at around $40 billion for construction, or perhaps $120 billion with operating expenses added in over a 30-year lifetime.

Still, the huge bills frighten Congress less than do NASA's recent mishaps. Whatever the cause, thinks Lori Garver, executive director of the National Space Society in Washington, "Congress will call for stricter oversight and possibly even be more careful about funding things like quality assurance and testing that came out to be the main problems with Hubble." But support for projects like the space station won't disappear, she predicts, saying that much of the tough talk boils down to grandstanding.

The Moon-Mars mission, on the other hand, could be hardest hit by NASA's recent technical troubles, says John Pike of the Federation of American Scientists. The flurry of criticism "has as much to do with general nervousness about whether we want to double NASA's budget and go to Mars as it does with the engineering problems themselves," Pike notes. NASA has given a combined figure of $500 billion for sending humans back to the Moon and on to Mars. If history is a guide, that estimate could double or triple.

Even so, spreading these costs over 30 years would make the Mars mission a smaller financial burden than Apollo was. The differences between the 1960s and the 1990s are a debilitated economy, a Congress unwilling to follow the administration lead, and a space agency that seems to have misplaced the right stuff. In an era of budget woes and cynicism about the nation's technological prowess, NASA probably needs to rehabilitate its image with some highly visible successes before Congress will launch it to Mars. ■

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THE SCIENCE WATCH
DAVID BALTIMORE

# In Defense of Tenure

MANY university administrators, sages, trustees, and undergraduates have been saying for some time that the tenure system has to go. Especially now that fixed ages of retirement have fallen victim to the charge of ageism, the calls for a system that allows for periodic evaluation of competence get louder.



*Though much maligned, the guarantee of faculty's job security gives universities their cohesion and identity.*

Renewal of the contract between the university and its faculty after a certain number of years may seem an attractive idea to some, but when I was a faculty member it sounded wrong to me; now that I am primarily an administrator, it still seems inappropriate. My reasons for this belief were unfocused until I read the spirited defense of tenure in *The University: An Owner's Manual,* the recent book by Dean Henry Rosovsky of Harvard. Rosovsky gives voice to my sense that tenure is the central element in the contract between a university and its faculty and that without it the university would lose cohesion and identity.

Tenure is classically defended as the guarantor of academic freedom, and in times of political stress it does at least partially serve to immunize faculty against the imposition of orthodoxy. But most faculty, especially in the sciences, rarely need such a shield. For them, tenure has the trade-union function of guaranteeing a job until retirement.

Rosovsky argues for a number of other equally important values of the tenure system. He reminds us that the process of granting tenure is a source of internal discipline in the evaluation processes of the university. It is actually the key element in the university's quality control procedures. The criteria used for deciding whether to grant tenure define the university's level of excellence.

To Rosovsky, the most important thing about tenure is that it is a social contract. It admits the faculty member to the university's nuclear family and ties the university and the professor in a tight bond. For a large percentage of science professors, tenure is partial payment of the huge debt owed them for staying with the university and thereby accepting much lower salaries than they could earn in industry. For others, tenure provides continuity and insulates them from often widely fluctuating university fortunes.

To me, one of the most important elements of tenure that Rosovsky enumerates is the "tenure track" process of evaluating the junior faculty. Holding out tenure as the end point provides criteria and a defined goal for the evaluation process. If the process is even-handed within a strict procedural framework, it appears to junior faculty as a fair set of hurdles and therefore boosts morale. The tenure track is an apprentice period, after which gaining tenure truly represents acceptance into a family. Thus tenure, even though it can lead to some "dead wood" if faculty members lose interest in staying current in their field, plays such an important role in the life of a university that tampering with it could be very detrimental.

But tenure is a two-way contract, and I am concerned that some faculty may not be fully honoring their side of the bargain. The faculty should play key roles in determining university policy, in

*Continued on page 78*



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# Waging War on Uncertainty

NOW that both the United States and the Soviet Union have declared the Cold War over, there is much agonizing about what role the nation's defense establishment will play in years to come. As Captain John H. Heidt, a teacher at the Naval War College in Newport, R.I., recently observed: "The enemy is no longer the Russians. The enemy is uncertainty."

This raises the question, How much firepower will we need to contain this new foe? How many armed divisions, MX missiles, and Trident submarines will it take to defend against uncertainty? In recent months we've seen an array of arguments to justify keeping the defense establishment substantially intact. True, there have been reductions in troop levels, plans to close military bases, and cuts in funding for new weapons development. But there have also been calls to fund the armed forces at close to their Cold War peak of $300 billion a year.

Some diehard supporters of our colossal defense budget cite the possibility that changes in the Soviet Union and Eastern Europe might turn sour and that hostilities between the superpowers might begin anew. Others claim that emerging conflicts around the world, such as Iraq's invasion of Kuwait, require the United States to maintain its forces at maximum strength. Whatever the validity of these arguments, they are also self-serving—signs that a muscle-bound military-industrial complex is resisting change.

Among the more colorful pretexts for sustained military spending are ones in which new missions are concocted for old Pentagon structures. Enlisting the armed services in a war on drugs is a favorite among politicians, reflecting the dubious notion that we can solve America's drug problem by pitting radar, ships, and fighter planes against cocaine smugglers. Other proposals would assign the military to tasks more suitable for other government organizations or for private industry.

Sen. Sam Nunn (D-Ga.), for example, has suggested that the armed forces join in a campaign against environmental destruction. Noting that problems like global warming and depletion of the ozone layer pose "a growing national security threat," Nunn called for the creation of a "strategic environmental research" program. The basic idea of this initiative is to use the equipment and personnel of the Pentagon, the CIA, and the Energy Department to study ecological deterioration around the globe. As part of this effort, the Navy's nuclear submarines could measure the thickness of the polar ice cap, a useful indicator of planetary climate change. As he made this proposal, Nunn candidly acknowledged his underlying motive: holding intact the nation's national security research apparatus at a time of diminishing threat from the Soviet Union.




*As the nation's longtime enemies evaporate, the military bureaucracy offers lame justifications for staying as big as ever.*

A similar trial balloon floated out recently from the National Security Agency. Responding to the prospect of budget cuts, NSA director William O. Studeman has recommended using the agency's electronic espionage network for international economic spying. His rationale is that the real battles ahead will involve the struggle for economic supremacy. The United States could ask its enormous espionage network to collect data on the industrial secrets of Japan, Germany, France, and other trading partners.

Such proposals tacitly recognize that many of the old reasons for spending hundreds of billions on defense are no longer compelling. But the new justifications seem awfully thin.

Certainly, there is a need for better information on environmental problems. But asking the Pentagon to lead the way is ludicrous. Its organization and competence have little to do with scientific research. Will our view of holes in the ozone be clearer through the windows of a B-2 bomber? The nation would do better to support researchers in the Environmental Protection Agency and university laboratories who study ecological issues.

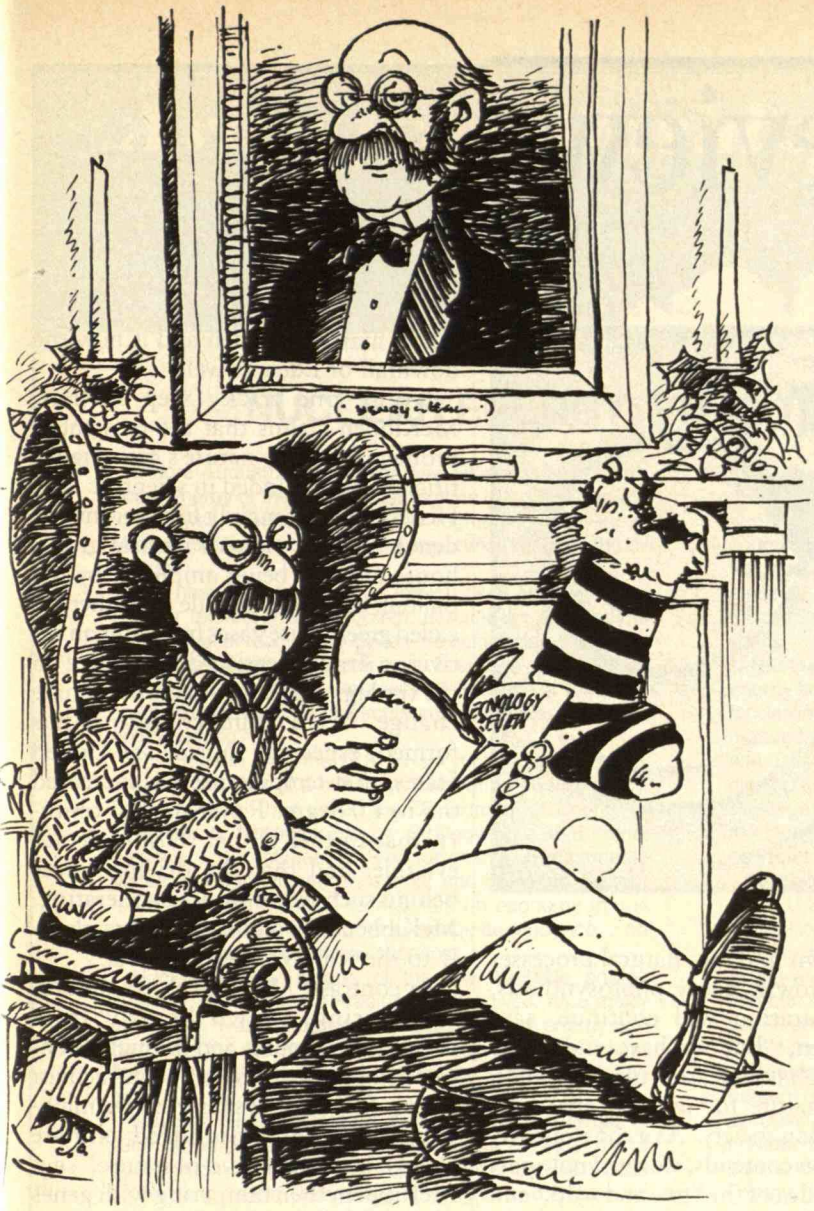
The idea of the government undertaking widespread economic espionage seems equally bizarre. It is doubtful that America's friends would appreciate such snooping. And to whom would the data be given? When IBM and Digital Equipment Corp. find themselves competing with each other as well as with foreign computer companies, who should get the spy reports? If sleuthing of this sort is so useful, business should pay for it.

The frantic search for new ends to justify outmoded military means could become a dangerous diversion as the United States reassesses its defense needs. One unhappy legacy of the Cold War is a grossly over-militarized national economy, one ill prepared to produce technologies, goods, and services that can pass muster in today's international marketplace. Faced with a unique opportunity to prune and restructure this hungry giant, the nation should be wary of claims that the Pentagon is merely a benign, multifaceted social-service organization. ■

*LANGDON WINNER teaches in the Department of Science and Technology Studies at Rensselaer Polytechnic Institute. His most recent book is* The Whale and the Reactor.



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# Reviews

BOOKS

EARTH WATCH

## IT AIN'T OVER TILL IT'S OVER

*The End of Nature*
by Bill McKibben
Random House, $19.95 (cloth)
Anchor Books, $9.95 (paper)

BY KATHLEEN COURRIER



AMERICAN writers from Thoreau to John Muir to Wendell Berry have struggled to define humanity's place in nature and nature's in humanity. Bill McKibben, a former staff writer at *The New Yorker,* has joined their ranks with his book-length inquiry into how the prospects of bioengineering and human-induced climate change alter not only nature itself but also the terms of humanity's lease on earth.

The thesis of *The End of Nature* is that nature is becoming irreversibly unpredictable thanks to human intervention, and that neither society nor the human psyche will ever be the same as a result. According to McKibben, we have "blindly, crudely, but effectively" rewritten the laws of nature, and any storm, drought, or other act of God from now on may or may not be natural. Rainfall and temperature regimes might be different from what they would be if people hadn't overrun the planet, and we may even be getting a cheap substitute for the immemorial round of seasons. According to McKibben, "summer is going extinct, replaced by something else that will be called 'summer.'" It may look and feel the same as summer always has, but the reinvented season cannot reassure us that another much like it is on the way. It's a difference detected in the mind, not on the skin.

In this brave new world increasingly of our own making, natural processes such as growth, decay, photosynthesis, and respiration will continue, says McKibben, "but we have ended the thing that has, at least in modern times, defined nature for us—its separation from human society." As a consequence, McKibben contends, we must now part with the idea of the "free and wild," and "we can no longer imagine that we are part of something larger than ourselves." Wilderness, even paradise, has become mere habitat.

Of course, people are part of nature, but the argument that anything they do is therefore natural strikes McKibben as semantic. Too often, he writes, it is used as an excuse to justify environmental destruction. So what is humanity's rightful place in nature? McKibben defines nature as "a set of human ideas about the world and our place in it"—not exactly a place to hang your hat.

As this logical predicament suggests, and the author himself acknowledges, the argument that nature has ended is at base religious or metaphysical. Like nothing else, he says, nature apart from man affords us "glimpses of immortality, design, and benevolence" and encounters with the eternal. If people are calling the shots, then they are playing God—a stance that has been the down fall of man since Eden and is now the downfall of Eden as well.

Going one tricky step farther, McKibben claims that the existential problem posed by nature's growing artificiality is grounded in scientific fact. His case springs mainly from recent evidence that the planet's natural greenhouse effect is being amplified by the buildup of carbon dioxide and other so-called greenhouse gases from human activities. True, scientists do not agree on the timing or precise effects of climate change. Yet a solid consensus has formed, especially outside the United States, that temperature has increased 0.5 to 1.0 degree F over the last century, that further global warming is inevitable, and that the driving forces behind such warming are accelerating. McKibben's lay scholarship hews closely to the readily accessible data.

In contrast, McKibben's fix on bioengineering, drawn heavily from newspaper accounts and the highly controversial work of environmental activist Jeremy Rifkin, strays far from the mainstream. If human-induced climate change is the first "end of nature," says McKibben, then tampering with genes is the second (and a worse end, because willed). The factual basis of this argument is sketchy, as is its logic. McKibben outlines the here-and-now perils of developing the genetically engineered "ice-nucleating" bacterium Frostban (thus risking proliferation, misapplication, and mutation) or a gene that helps tobacco withstand the herbicide Roundup (thus allowing farmers to grow more tobacco and spray more herbicides). But from there he leaps too quickly to the sci-fi prospect of mass-produced chickens without heads or tails and people "biocosmetically" equipped with sonar, double-glazed eyes, or the ability to digest cellulose. The forbidding economics of far less ambitious bioengineering ventures makes it highly unlikely that scientists could or would serve up superefficient headless foul anytime soon, if ever. What's more, the current regulatory checks on experimentation with the hu-

ILLUSTRATIONS: DAVE RIDLEY

# A view from Washington

## NUCLEAR ENERGY: VITAL TO U.S. SECURITY

Before August 2, Americans saw little reason to worry about energy or the Middle East. But the Iraqi blitzkreig into tiny Kuwait reminded us of the frightening volatility of Mideast politics, and the folly of importing half of all the oil we use.

Our heavy dependence on foreign oil is aggravated by another related energy problem: demand for electricity is growing faster than new supplies are being added. Reliable service is suffering in parts of the U.S. and we're using more imported oil to supply electricity. Will it take a full-scale crisis, like widespread blackouts and oil cutoffs, before we do something?

One reason why the U.S. is so vulnerable to energy crises is the lack of a coherent, long-range energy policy. President Bush has asked the Department of Energy to formulate a National Energy Strategy, one that "must balance ... our increasing need for energy at reasonable prices, our commitment to a safer and healthier environment, our determination to maintain an economy that is second to none, and our goal to reduce dependence ... on potentially unreliable energy suppliers..."

Nuclear energy is one of the few available energy sources that meets the President's objectives. As a major part of our National Energy Strategy, nuclear energy can help steer the nation away from an energy crisis and toward the security that will free us from the whims of foreign nations.

**Nuclear Energy Fosters Energy Independence.** In 1989, we imported over 40 percent of our oil, at a cost of $860 million per week – about 40 percent of last year's $109 billion trade deficit. These staggering figures would be even worse without America's 112 nuclear energy plants. Since the 1973 oil embargo, U.S. nuclear energy plants have saved us 4.3 billion barrels of oil and $125 billion in foreign oil payments. These savings continue to mount, and new nuclear energy plants can help assure more energy independence.

**Nuclear Energy Spurs Economic Growth.** There is a clear, continuing relationship between electricity and economic growth. Since 1973, our Gross National Product has grown 51 percent, while electrical consumption has grown 54 percent. In contrast, use of non-electric forms of energy actually fell by six percent. Nuclear energy has a key role to play in fueling future economic growth. It has supplied 36 percent of all new electricity since 1973, and today, nuclear energy is our second-largest source of electricity, behind coal.

**Nuclear Energy Meets Our Energy Demands.** Both the U.S. economy and electrical demand are expected to grow at 2 to 3 percent each year until the end of the decade. But planned new electrical generating capacity will not meet that growth. Some utilities have already experienced demand not expected until the mid-1990s. As electricity supplies tighten, we'll need every secure generating source, including nuclear energy, to maintain reliability. And we must avoid increasing the use of oil to generate that electricity. Unfortunately, our use of oil to generate electricity has grown by more than 34 percent in the past two years.

**Nuclear Energy Protects The Environment.** Nuclear energy is one of the cleanest sources of electricity available for large-scale use. Last year, nuclear electric plants reduced U.S. sulfur dioxide emissions by 5 million tons, nitrogen oxide emissions by two million tons, and carbon dioxide emissions by 128 million tons The small volume of waste generated by nuclear energy plants has been safely managed at plant sites in steel-lined storage pools, posing no threat to the environment.

**Nuclear Energy Saves Consumers Money.** Since 1973, U.S. nuclear energy plants have saved consumers $45 billion compared to the other fuels – coals, oil and natural gas – that would otherwise have been used to supply electric power. New advanced-design nuclear plants that can be built in the 1990s will be cost-competitive with coal-fired electricity, and will provide electricity cheaper than either oil or gas-fired plants.

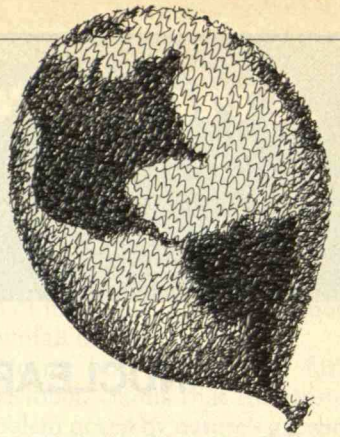
**Nuclear Energy Has Public Support.** Eighty-three percent of Americans say nuclear energy will be important in meeting our future electricity needs, and almost the same number believe the U.S. will need more nuclear energy plants. Nearly 70 percent say we should use more nuclear energy to combat the problem of greenhouse gas emissions and global warming. And, by more than 2-to-1, Americans prefer using more nuclear energy over importing more oil.

Clearly, Americans recognize the many benefits of nuclear energy, and are counting on its benefits in the future. The National Energy Strategy should allow nuclear energy to serve the needs of our country, including reducing our dependence on unstable foreign governments. By ensuring a strong future for nuclear energy, our policymakers will be helping to assure a bright energy future for Americans.



Harold B. Finger
*President and Chief Executive Officer*
*U.S. Council For Energy Awareness*

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man genome make the prospect of artificially enhanced senses or a new, improved digestive system seem remote indeed. At the National Institutes of Health, for example, experiments with human genes are permitted only if multiple tiers of review panels (including ethics committees) and NIH's director approve, and if no effective therapy exists for the condition researchers hope to conquer genetically.

To his credit, McKibben's lament on hubris and human dominion over nature does sound a wake-up call as rousing as any since biologist David Ehrenfeld's *Arrogance of Humanism* (Oxford, 1978). He's also right that the pace of the climate change now widely predicted is without historical analog, that nature can be pushed only so far without reacting in ways that might shrink *Homo sapiens'* ecological niche, and that by almost any reckoning human alteration of the planet has reached a dizzying speed. But whether we have crossed a critical threshold or, less tragically, have simply taken steps that could cost us dearly remains an open question.

### Freeing the Slave of Nature

The practical response McKibben proposes to the crisis he has described raises even more questions. Though prefaced with the reminder that it may already be too late, his plea that we waste less, consume less, and even *think* less about consumption squares with his timely call to "meet the world's poor halfway" by sharing our wealth and limiting our appetite for natural resources. But the other half of his prescription—freeing the "slave" of nature by suppressing the desire for personal happiness and giving up our anthropocentric view of nature—sounds disturbingly like the end of *human* nature. (For that matter, maybe every creature with a central nervous system sees itself as the center of the universe.) Although the incentives for mending our tomorrow-be-damned ways have never been greater, the kind of profound change McKibben considers necessary is evolutionary. To hope that either the pampered or the hungry will suddenly become less self-interested is to despair, as he ultimately does, and to ignore what is humanly and politically possible now.

McKibben has wrestled far harder with what is wrong than with what can be done to make amends. He regards strict environmental controls like those now being considered to save Los Angeles from itself as steps in the right direction. He applauds energy conservation. He even agonizes over the rightness of bringing into the world more children to pollute it. But perhaps because he believes we have already gone too far, he ignores current debates on restructuring poor countries' debts to ease export pressures on natural resources, on "greening" technology to recycle wastes, and on the fate of national governments that can't keep pace with environmental change. All of these could yield solutions that go well beyond the quick technological fixes McKibben and many others blame for much of our current predicament.

More troubling, McKibben also seems unaware of growing evidence that nature has never been as steady or predictable as it is often painted. Recent studies of calcified pollen suggest that multi-millennial cycles of climate change and of species die-outs and migrations might form a pattern that we can't yet fathom. What passes for radical climate changes in human time may be no more than flukes when seen on a larger scale. Such new evidence does not mean that the speed of the predicted global warming should not give us top carnivores pause, but it does mean that McKibben may be mourning what never was. This may be one reason why other observers—those with a deeper understanding of human beings' place in the web of life and of ecological dynamics generally—are less pessimistic than McKibben about what can be done to keep earth habitable.

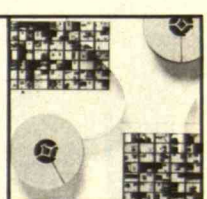
### Overloaded Analogies

McKibben has captured attention where more broadly informed and less apocalyptic science writers haven't partly because of his extraordinary gift for language, especially for concocting stunning analogies. Comparing past record-breaking temperatures with today's, he writes, "is like hanging Rembrandts next to Warhols; we live in a postnatural world." As for the human rule over nature, "we sit astride the world like some military dictator, some smelly Papa Doc . . . able to wreak violence with great efficiency and to destroy all that is good and worthwhile, but not to exercise power to any real end."

Yet analogies also get McKibben into trouble. Scientists, policymakers, and the rest of us are all vexed by the unknowns surrounding the timing, scale, and interaction of climate change's impacts. Seemingly unable to tolerate that uncertainty, McKibben has built an argument around analogies—by definition, illuminating half-truths—and leapt to conclusions that can't be substantiated by the facts he has collected, much less by the body of ecological literature that he largely ignores. Its periodic flashes of brilliance make *The End of Nature* worth reading, but it is clearly the work of a recent convert blinded by the light. ■

*KATHLEEN COURRIER is publications director at the World Resources Institute in Washington, D.C., and a contributor to* The Greenhouse Trap *(Beacon Press, 1990).*

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TELEVISION

EARTH WATCH

# HAS THE EARTH HAD ITS DAY?

*Race to Save the Planet*
PBS, 10 one-hour programs
Thursdays 8:00 p.m. ET
Oct. 4-Dec. 6, 1990

BY JEANNE McDERMOTT

JUST when the world seemed safe from nuclear annihilation, along comes a new vision of apocalypse. *Race to Save the Planet,* a 10-part series airing on public television this fall, tells us what Pogo knew all along: the enemy is us.

*Race to Save the Planet* offers a dazzling array of images not only of the earth's environmental problems but of imaginative, pragmatic solutions as well. You see time-lapse photography of the daily smog buildup in the Los Angeles Basin, an area so polluted that charcoal barbecues will soon be banned. And you witness the deplorable state of the Rhine River. Sediments dredged from its bottom are treated like toxic waste, consigned to vast artificial ponds that are fast filling up. Where 150 species of fish once flourished, only 12 species remain today. Amazingly enough, the city of Amsterdam draws its drinking water from the Rhine. The water is first cleansed at a state-of-the-art purification facility and then percolated through a series of artificial streams in the countryside for three years.

Things are even worse in developing countries. The series shows the outfall of an open sewer in Lima, Peru, where children come to swim. You watch a woman in an Indian village point to a water mark on the walls of her modest home and learn that it is runoff from a toxic waste holding pond. So murky is the air in Bangkok that you can barely see the cars. Realistically, as the series points out, the solution to these problems is not simply to buy sophisticated treatment plants or mandate catalytic converters. It involves the much more difficult and urgent battle against poverty.

*Race to Save the Planet* is an almost ridiculously ambitious undertaking in the amount of information it encompasses. It was filmed in 30 countries, on all seven continents. The first show, "The Environmental Revolution," encapsulated the last 12,000 years of human history. The series has since tackled global climate change, air pollution, water pollution, and economic development. And future programs will cover biodiversity, energy, agriculture, waste, politics, and what individuals can do to make a change.

If the series did nothing but dwell on the 101 flavors of environmental disaster, it would simply be another grim reprimand about the planetary mess the human species has made. Happily, that is not the case. What makes *Race to Save the Planet* so compelling to watch, what makes it valuable for the person in the street as well as policymakers, is that it shows how our economic fortunes and environmental fates are inextricably linked.

Like all ambitious projects, the series is uneven. Those who tuned into the first show may have been turned off by the introduction. "All this belongs to God," says series host Meryl Streep, gesturing to the pond and forest behind her Connecticut home. "It is our responsibility and privilege to take care of it." Is environmental activism simply a form of noblesse oblige? In the series conclusion, "It Needs Political Decisions," a Soviet environmentalist says it better. "We were taught that man is the czar of nature. But man is a small part. If we continue to disturb the balance, the result will be not only nature's destruction but man's destruction. Nature will remain, but it will flick man off the earth and carry on without him."

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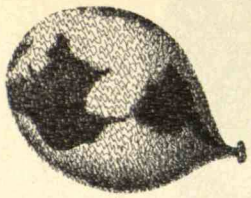
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have a decade before disaster catches up and the environment is irreversibly changed. Lester Brown, president of the Washington, D.C.–based Worldwatch Institute—whose *State of the World* reports provided the concept for the series—gives us 40 years. Such convenient round numbers seem not only arbitrary but hysterical, designed to scare us out of complacency. What I find more terrifying is that we simply don't know when time will run out.

The consequences of that ignorance become apparent in "Only One Atmosphere," an excellent treatment of a subject fraught with uncertainties: global climate change. By releasing carbon dioxide, chlorofluorocarbons, and methane into the atmosphere, we are changing the climate 10 to 100 times faster than natural processes, according to computer models used by climatologist Stephen Schneider and others. Some experts predict violent storms, drought, famine, and global flooding. In the latter case, would we simply abandon coastal cities? Or do what the Dutch have done? They spend $10 billion a year, or 1 percent of GNP, to keep the sea out of their country. The show notes that it would be cheaper to cut down the release of carbon dioxide, by mandating more energy-efficient cars.

Another excellent program, the upcoming "Remnants of Eden," examines the conflict between the needs of wild species and burgeoning human populations. While the immediate needs of local people typically win out, it may be to our global long-term detriment. As entomologist E.O. Wilson says, "Environmental destruction is like burning Renaissance paintings to cook dinner." Yet according to a cabinet minister in Costa Rica, a country well known for preserving wild areas, people do so out of ignorance or necessity. The show looks at efforts to change people's way of life. A government-sponsored program in Thailand, for example, gives villagers low-interest loans to set up dairy farms and water conservation projects instead of hunting and logging in a nearby wildlife preserve.

The show that is the richest source of practical ideas for the average citizen is "More for Less." It tackles a subject that puts most people to sleep, energy conservation, transforming it into a tribute to frugality. You meet the man who designed a Volvo that gets 100 miles to the gallon on the highway, and runs on Mazola corn oil. You travel to Osage, Iowa, the energy conservation capital of America; its government sparked consumer interest in conservation by taking infrared photographs of every home to show homeowners where energy was being lost. And you peek inside the briefcase of energy guru Amory Lovins to glimpse his secret weapons: energy-efficient light bulbs.

The message here, as elsewhere in *Race to Save the Planet,* is simple: little things add up—in what we do to pollute the environment and what we do to clean it up. ■

*JEANNE McDERMOTT is the author of* The Killing Winds: The Menace of Biological Warfare.

## BALTIMORE/CONTINUED

curriculum design, and in hiring. They must teach and advise students. The demands of scholarly life—especially those driven by a need for large sums of money to carry out scientific research—take professors away from the university and absorb their concentration when they are in residence. With so much support coming directly to scientists from the federal government, the allegiance to the university is diluted. Also, research, travel, and the adulation of colleagues are often more personally rewarding than hassling with other faculty over course structure or facing unappreciative undergraduates. Although tenure is a crucial element in defining universities, the calls for altering the system may swell unless the faculty acknowledges its responsibilities more clearly. ■

*DAVID BALTIMORE is president of The Rockefeller University in New York.*

ple are only half as efficient as others in removing the phenylalanine in aspartame from their blood. Aspartame is consumed in widely different doses and along with substances that amplify its effects. All this substantiates my concern and suggests that the real risk aspartame poses for carriers of phenylketonuria is difficult to assess from laboratory data.

Also, the idea of carbohydrate craving arises from the perception that people normally regulate their intake of carbohydrates and protein, and that they do so in accordance with the different effects these nutrients have on brain serotonin. This mechanism probably explains why most people eat about 13 percent of their total calories as protein and why the ratio of carbohydrate to protein in the diet is usually four or five to one.

Studies on humans with a wide variety of diseases—for example, obesity, winter depression, and premenstrual syndrome—have amply shown that such patients do crave carbohydrates, probably because they have learned that those nutrients improve their mood. Furthermore, the carbohydrate-craving phenomenon has recently led to a strategy for treating obesity with drugs that increase brain serotonin. Two extremely successful drugs have been developed for use in this strategy—Dexfenfluramine in Europe and flueoxitine (Prozac) in the United States.

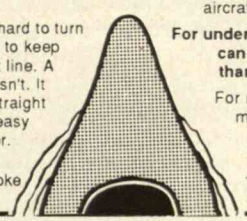
And my chocolate-cake example is important because it characterizes what lots of aspartame users do: take aspartame and carbohydrates at the same time—say, by drinking a Diet Coke while eating a Snickers bar. Metabolically this is the worst possible circumstance, since the insulin released by carbohydrates forces more of the phenylalanine in aspartame into the brain. Fernstrom overlooks that a chocolate cake that contains both aspartame and a carbohydrate like flour could, by itself, have this damaging effect. I assume he thus shares my view that aspartame should not be used to make chocolate cake.

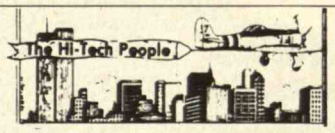

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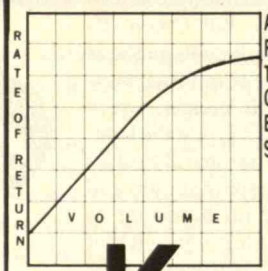


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# Notes



## Tasteful Computer

Murray Goodman's computer "tastes" by examining the architecture of a family of molecules that includes Nutrasweet. Goodman has distilled two decades of research on the structure of sweetness into a 3-D computer model. With it, he can design a new peptide and predict from its size and structure if it will be sweet, bitter, or tasteless.

A University of California at San Diego chemist, Goodman reported his work to a recent American Chemical Society meeting. His long-term goal is to learn how seemingly unrelated molecules—from plant sugars to proteins—can taste alike.

## Alternative Space Station

NASA should replace its "troubled space-station project" with "an updated version of our former space station, *Skylab II*," says Rep. Bill Green (R-N.Y.). The ranking Republican on the House committee overseeing NASA's budget, Green has told the IEEE that the United States has invested almost $4 billion in the space station and has "almost no hardware to show for it." He points out that on a *Skylab,* astronauts could run microgravity and life-science experiments, "the two primary reasons . . . we are told that we need the $30 billion space station."

## Hair-Trigger Lawsuit

Clifford Johnson, a computer manager at Stanford University and chair of the Palo Alto chapter of Computer Professionals for Social Responsibility, has sued Strategic Air Command (SAC) commander-in-chief Gen. John Chain and the agency's chain of command. Johnson alleges that the computerized hair-trigger on Minuteman and MX missiles poses an immediate danger of massive accidental launch.

The lawsuit says that standing orders keeping 99.5 percent of the missiles ready for the turn of a key are inherently reckless, endanger life, and jeopardize the peace. But federal district court judge Spencer Williams has agreed with Chain that Johnson "lacks standing" to sue SAC. Williams dismissed the case, and an appeal is pending.

## Twinkies Are No Defense

In 1978, the murderer of San Francisco mayor George Moscone and city supervisor Harvey Milk got off with a light sentence by claiming that sugar-laden junk food had made him less responsible for his behavior—the so-called Twinkie defense. Similar sweet logic has also prompted some juvenile correction centers to reduce the sugar in the diets of male delinquents.



However, a controlled nutritional and psychological study of delinquents refutes the idea that sugar causes crime. In fact, says University of Wisconsin psychologist Joseph Newman, some white delinquents actually did slightly better on some performance tests, although he stresses that sugar is no cure for delinquency.

## Catch a Number

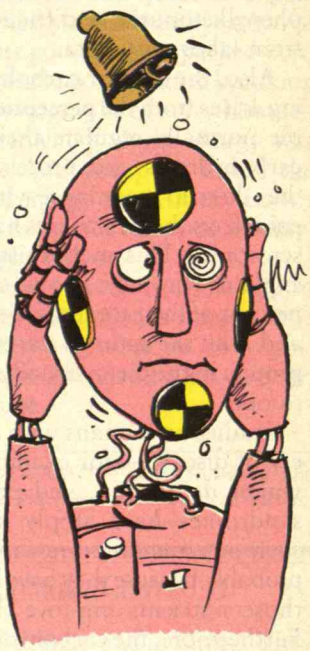
Two mathematicians have accomplished a feat that eluded savants for nearly 300 years: factoring the world's "most wanted" number. But the triumph exposes the vulnerability of cryptography systems, which have relied upon the barriers to factoring big numbers. "Once an unauthorized person figures out how to factor a number, it's only a matter of seconds before they can successfully decipher messages based upon that number," Digital's Mark Manasse warns.

Manasse and Bellcore's Arjen Lenstra tied together almost 1,000 computers worldwide and used the equivalent of 275 years of time on a medium-powered computer to factor the 155-digit number.

## Get a Dog

A year-long study of 1,000 Medicare enrollees in an HMO has supplied empirical evidence that elders with pets visit doctors less often than those without pets. In the *Journal of Personality and Social Psychology,* UCLA psychologist Judith Siegel writes that "pets seemed to help their owners in times of stress."

Among elders under the most stress, pet owners had 16 percent fewer physician visits. Siegel attributes that to the companionship and comfort an animal can provide. And dogs do the best job: highly stressed canine owners had 21 percent fewer physician contacts than comparable petless subjects.



## Ring Out the Old

The skulls on today's crash dummies can't meet the demands of testing ejection seats for high-speed aircraft, according to Penn State aerospace engineers David Jensen and James August. Thus, the two men are designing a new skull out of composite materials.

Current mannequin skulls are hollow aluminum. Inside, instruments monitor such factors as the forces transmitted to the neck, helping reveal what the effects of a crash might be on humans. The aluminum heads work okay at low acceleration, but high acceleration makes them "resonate at a natural frequency," says Jensen. "Basically, the aluminum skull rings and makes data collection impossible."



ILLUSTRATIONS: JON McINTOSH

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